Memoirs of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE.

Vol. XXIII. No. 2.

REPORTS ON AN EXPLORATION OFF THE WEST COASTS OF MEXICO, CENTRAL AND SOUTH AMERICA, AND OFF THE GALAPAGOS ISLANDS, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," DURING 1891, LIEUT. COMMANDER Z. L. TANNER, U. S. N., COMMANDING.

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THE OPHIURIDÆ.

By C. F. LÜTKEN and TH. MORTENSEN.

WITH TWENTY-TWO PLATES,
AND A CHART OF THE ROUTE.

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PREFACE.

It was originally intended that the Ophiuridæ of the "Albatross" Expedition should be studied by only one of the present authors. The eminent American specialist in Ophiurans, Theodore Lyman, to whom the task would naturally have fallen, was ill, and it was undertaken by Professor Lütken. Having made a preliminary determination and description of almost all the new species, he saw that he should not have time to do the work thoroughly, and, with the permission of Mr. Agassiz, the other author, Dr. Th. Mortensen, was engaged, and we have accomplished it together. The figures were drawn by Dr. Mortensen except Figure 8, in Plate XX., and Plates XXI. and XXII., which were drawn by Mr. Bentzen-Bilkvist, who also lithographed all the figures. We cannot conclude our work without offering him our best thanks, as without his eminent skill the plates would have been far inferior to what they have now become. Much stress has been laid upon making the figures as correct and as distinct as possible. Every one who has to determine Ophiurans knows what trouble bad figures give. Moreover, whenever we have found details which are not sufficiently distinct or correct in the figures, it has always been noted in the description of the species figured. We hope, therefore, that it will be comparatively easy to recognize the species here described.

We have given a list of the papers on Ophiurids published subsequently to Lyman's Monograph in 1882; and finally we have enumerated all the new species with references to the works in which they are described. We think that this will be of some value to those who are working on Ophiurids.

The Authors.

Copenhagen, May, 1898.

THE OPHIURIDÆ.

I. INTRODUCTION.

The total number of species of Ophiurids from the "Albatross" Expedition is sixty-six. Of these one genus and fifty-three species are new. This is truly an astonishingly great number of new species, but such is the case almost everywhere, where more careful researches are made. We need only name the "Blake," the "Caudan," and the "Investigator." This gives an idea of what riches of forms must be found in the immense regions of the great oceans, which are still almost unknown. There are now known about one thousand species of Ophiurans. We may safely say that, when all the great oceans and all the tropical shores have been sufficiently well investigated, the number will have increased to about double.

The "Challenger" Expedition got only seven species of Ophiurans in the part of the Pacific between Juan Fernandez and Valparaiso (Stations 296, 298, 299), namely: *Ophioglypha Lacazei* Lym., *Ophiomusium Lymani* Wyv. Thoms., *O. armigerum* Lym., *Amphilepis patens* Lym., *Ophiacantha cosmica* Lym., *O. sentosa* Lym., and *Ophiotholia supplicans* Lym. Of these we have found only three among the "Albatross" Ophiuridæ: *Ophiomusium Lymani*, *Amphilepis patens*, and *Ophiacantha cosmica*. Further, *Ophiacantha Normani* Lym., which was taken by the "Challenger" in the eastern part of the Pacific, is found in great numbers among the "Albatross" Ophiuridæ.

The following species were taken by the "Albatross" Expedition: —

1. *Ophioderma panamensis* Ltk.
2. *variegata* Ltk.
3. **Ophiozona contigua** n. sp.
4. **alba** n. sp.
5. **Ophiernus seminudus** n. sp.
6. **Ophiernus annectens** n. sp.
7. **polyporus** n. sp.
8. **Gymnophiura mollis** n. g., n. sp.
9. **cœrulescens** n. sp.
10. **Ophioglypha superba** n. sp.

11. **Ophioglypha abcisa** n. sp.
12. **obtecta** n. sp.
13. **tumulosa** n. sp.
14. **plana** n sp.
15. **scutellata** n. sp.
16. **nana** n. sp.
17. **divisa** n. sp.
18. **Ophiocten pacificum** n. sp.
19. **Ophiomusium glabrum** n. sp.
20. **Diomedeæ** n. sp.
21. **variabile** n. sp.
22. *Lymani* Wyv. Thoms.
23. *Ophiactis Savignyi* (M. & Tr.).
24. **profundi** n. sp.
25. *duplicata* (Lym.).
26. **Amphiura serpentina** n. sp.
27. **gymnogastra** n. sp.
28. **polyacantha** n. sp.
29. **seminuda** n. sp.
30. **brevipes** n. sp.
31. **gymnopora** n. sp.
32. **Diomedeæ** n. sp.
33. **assimilis** n. sp.
34. *dalea* Lym.
35. **granulata** n. sp.
36. **gastracantha** n. sp.
37. **notacantha** n. sp.
38. *sp.*
39. **Amphiura papillata** n. sp.
40. *Amphilepis patens* Lym.
41. *Ophionereis annulata* Lym.
42. **nuda** n. sp.
43. **Ophiochiton carinatus** n. sp.
44. *Ophiacantha cosmica* Lym.
45. **pacifica** n. sp.
46. **inconspicua** n. sp.
47. **spinifera** n. sp.
48. *Normani* Lym.
49. **moniliformis** n. sp.
50. **costata** n. sp.
51. **contigua** n. sp.
52. **hirta** n. sp.
53. **paucispina** n. sp.
54. *Bairdi* Lym.
55. **Ophiomitra granifera** n. sp.
56. **partita** n. sp.
57. **Ophiothamnus lævis** n. sp.
58. *Ophiothrix spiculata* le Conte.
59. **galapagensis** n. sp.
60. **Ophiomyxa panamensis** n. sp.
61. **Sigsbeia lineata** n. sp.
62. **Asteronyx dispar** n. sp.
63. **excavata** n. sp.
64. **plana** n. sp.
65. **Astroschema sublæve** n. sp.
66. **Gorgonocephalus Diomedeæ** n. sp.

Four of these species are first described from the Atlantic Ocean or the West Indies, viz. : —

Ophiomusium Lymani Wyv. Thoms.
Amphiura dalea Lym.
Ophiactis duplicata (Lym.).
Ophiacantha Bairdi Lym.

The following species are very closely allied to species from the Atlantic or the West Indies: —

Ophiernus seminudus to *O. vallincola* Lym.
Ophiernus annectens to *O. adspersus* Lym.
Ophioglypha divisa to *O. inornata* Lym.
Amphiura gymnogastra to *A. semiermis* Lym.
Ophiocantha paucispina to *O. Bartletti* Lym.
Sigsbeia lineata to *S. murrhina* Lym.

Astroschema sublæve to *A. clavigera* Verr.

Ophiozona alba is very closely allied to *O. depressa* Lym., from the Philippines.

Evidently there are very interesting relations in the geographical distribution of Ophiurids. The material here collected gives some hints of the relation between the fauna of the West Indies and that of the Pacific. However, we find that there is needed yet more information as to the distribution of the species before any definite results can be given. And it should be well remembered that we must study the distribution of every species separately. For the littoral species we refer to LÜTKEN, Additamenta ad Historiam Ophiuridarum, Part II. (Vidensk. Selsk. Skrifter Kjöbenhavn, 5 Raekke, Mathem. naturv. Afd., Bd. V., 1861), and to VERRILL, Notes on the Radiata in the Museum of Yale College, Part II. (Trans. Connecticut Acad. of Arts and Sciences, Vol. I., 1867).

Possibly we have made too many new species. It may be doubted whether the two *Ophiernus* species, *seminudus* and *annectens*, are really different from the two Atlantic species named above. Be that as it may, if only the descriptions and figures are good, there cannot be much harm done: — a few synonyms more, — this fault is easily corrected. We have thought it would be worse, if any species were wrongly referred to a species already known, especially in a case where the identifying of such forms usually means that they are found in both the Pacific and the Atlantic Ocean.

The classification of the Ophiurids is still in a rather imperfect condition. Not even the families are finally settled, and several of the genera are very insufficiently defined. LYMAN, who has described so vast a number of species, had not, unfortunately, much perception of the relations of the forms. Though he had so large and excellent a material, he gives in his great monograph only a very rude grouping of the genera, which affords no idea of their real relations. BELL's classification (19) also scarcely expresses the real relation of all the genera, though no small progress was made thereby toward a natural classification. As one of the present authors (DR. MORTENSEN) purposes to give later a complete revision of the whole class of the Ophiurids, we shall here still follow the ordinary method, by naming the genera one after another, usually in the accustomed order.

II. DESCRIPTION OF SPECIES.

1. Ophioderma panamensis Ltk.

LÜTKEN: Additamenta ad Hist. Oph., Part II. p. 193.

Panama. 1 specimen.

2. Ophioderma variegata Ltk.

Plate I. Figs. 1-3.

LÜTKEN: *Op cit.*, Part II. p. 199.

To this species we refer a specimen from Panama, although it seems at first sight to differ rather widely therefrom, the disk being almost entirely destitute of the granulæ with which the species of *Ophioderma* commonly are covered, and instead thereof being covered with small, irregular, not overlapping scales, among which the primary plates are not to be seen. In all other respects it closely resembles the *O. variegata.* However, there are seen by closer examination some granulæ here and there, in spots, where they have been protected from being rubbed off, as especially at the arm-bases on the under side of the disk. It is therefore almost sure that there have been granulæ covering the whole disk. Also the arm-spines and the tentacle scales have mostly been broken off. This has caused an error in Figure 1: only one tentacle scale is seen there; after the figure had been reproduced, we found traces of the outer tentacle scale also, so that there will not be any difference from other species of *Ophioderma* in this respect. The color also corresponds to that of the two specimens of *O. variegata*, which are preserved in the Museum at Copenhagen; the arms are colored alternately with dark brown and white (faintly reddish) bands, each band enclosing 2–3 joints. In the figures of this species, (which has not been previously figured,) it is represented without the covering of granulæ. In the other species of *Ophioderma* there will be a similar covering of scales beneath the granulæ.

On Figure 1, there is seen at the inner edge of the second ventral plate a pair of small pores, whose significance is wholly unknown to us. The same pores we found in all the species of *Ophioderma* which we have examined;

in some species there are two pairs of pores, the second at the inner edge of the third ventral plate. One pair was found besides in *O. variegata*, in *O. brevispina* Say, and *O. Januarii* Ltk.; two pairs were found in *O. brevicauda* Ltk., *O. cinereum* M. Tr. (= *antillarum* Ltk.), *lacertosa* Lmk., *rubicunda* Ltk., and *O. appressa* Say (= *virescens* Ltk.). Possibly this may be of systematic importance.

We should not be much surprised if *O. brevispina* Say (= *serpens* Ltk.) and *O. Holmesii* Lym. should turn out to be the same species as *O. variegata*. Between *O. brevispina* and *variegata* there seems to be no difference except in the color; but as the color is highly variable in these forms, that will scarcely be sufficient for maintaining them as two species. Of *O. Holmesii*, LYMAN* says, "This species stands between *O. brevispina* and *O. olivacea*." In the "Challenger" Monograph he makes *O. brevispina* and *O. olivacea* synonyms, but maintains *O. Holmesii* as a distinct species, without giving further reasons for it. It seems that *O. Holmesii* is only a larger specimen of *O. brevispina;* all these species would thus be reduced to one, whose name should be *O. brevispina* Say. But we cannot say that with certainty for want of material for comparison.

3. Ophiozona contigua n. sp.

Plate VI. Figs. 10-12.

Diameter of disk, 10 mm.; width of arms close to disk, 1.8 mm.; length of arms, 35 mm. Five to six mouth papillæ on each side of the mouth angle; the outer one very small, the next one much larger than the others, rounded; the three or four inner ones more or less conical, as is the one on the apex of the jaw. The teeth are pointed. Mouth shield a little longer than broad, with an angle within and outer edge rounded; lateral sides a little restricted through the genital slits; the outer end is the widest. Side mouth shields short and rather wide, meeting within, almost equally broad in their whole length.

First ventral plate very small, five-sided; those beyond a little longer than wide, in mutual contact almost, but not quite, to the end of the arm. Their inner end is truncated, their outer edge strongly curved, or with a rounded peak. Inner laterals re-enteringly curved, outer laterals restricted through the tentacle pores. Farther out on the arm, before they are sepa-

*Ophiuridæ and Astrophytidæ, Old and New. Illustr. Catalogue Mus. Comp. Zoöl., Vol. I. p. 22.

rated, the ventral plates are rather long and narrow. Side arm-plates with outer edge somewhat thick and prominent; they meet above only in the outer third or half of the arm. Dorsal plates a little wider than long, (sometimes a little broader than figured,) rather broadly in contact far out on the arm; their inner edge is much narrower than the outer, concave, outer edge convex, lateral sides almost straight, or feebly re-enteringly curved; in the outer part of the arm the dorsal plates are triangular. The first dorsal plate is very short; inside that there are some small, irregular, crowded scales, which cannot be regarded as rudimentary dorsal plates. The arms rather stiff, round; the joints a little nodose.

Disk covered with stout overlapping scales, among which the primary plates are very conspicuous, making a rosette in the middle of the disk; they lie close together, not separated by smaller scales, sometimes, however, there are five very small scales between them, joining the central plate. The radial shields are small, only about a third of the radius of the disk, triangular, widely separated through a single series of scales. In the interbrachial spaces there is a rather large marginal plate, which is separated from the radial shields by a series of narrow scales. The under side of the disk is covered by scales similar to the smaller ones on the dorsal side. The genital scale very narrow, but distinct almost in the whole length. The edge of the disk is rather sharp. The genital slits reach to the end of the second arm-joint or to the middle of the third joint, but from that point there is a deep furrow to the margin of the disk, so that it looks as if the genital slits did reach to the margin. No genital papillæ.

Two rather thick, not pointed arm-spines, about as long as an arm-joint; sometimes the upper one, sometimes the lower one, is a little longer than the other, sometimes they are equally long. There are spines also on the first two joints. One large round tentacle scale, continuing to the end of the arm; also the inner pores have only one tentacle scale.

Color in alcohol: white.

Station 3400, 1322 fathoms; 5 specimens. St. 3413, 1360 fathoms; 1 specimen.

4. Ophiozona alba n. sp.

Plate VI. Figs. 7-9.

Diameter of disk, 12 mm.; width of arm close to disk, 2 mm.; length of arms scarcely four times the diameter of disk. Four to six short, close set

mouth papillæ. The outer one is very small, the next one is the largest of them all, rounded; the next one to three are square, and finally the inner one usually pointed. Sometimes there is a little median papilla below the teeth, but it seems to be typical that there is no median infradental papilla. The four to five teeth are broad, square, or slightly rounded. Mouth shield a little wider than long, with an acute angle within and outer edge rounded. The inner sides are re-enteringly curved, lateral sides straight, outer corners rounded. Side mouth shields very short and broad, meeting within; their outer end much broader than the inner end.

First ventral plate very small, regularly five-sided, with an angle inward. Those beyond a little longer than broad, in mutual contact to the fifth or sixth joint, farther off widely separated by the side arm-plates. The second to sixth have their inner angle truncated, the piece in contact rapidly diminishing in width; those beyond the sixth have an acute angle within. The outer side in the first one or two plates is limited by three straight lines, meeting under obtuse angles; farther off there are only two straight lines, which make an obtuse angle in the median line; sometimes the outer edge is more rounded. The lateral sides are restricted on the middle by the tentacle pores; inner part re-enteringly curved, outer straight, so directed as to make an acute angle with the longitudinal axis of the arm. Side arm-plates with the sides curved, outer edge rather thick and prominent, rounded; on the three joints in the disk they are wholly straight, outer edge not thickened. Dorsal plates almost rhomboidal. The three to four inner ones are in mutual contact, and have thus their inner angle truncated; from the fourth or fifth they are separated by the side arm-plates, and have an acute angle within; all the sides are a little rounded. They are rather thick and high, as wide as long. The first dorsal plate has the outer edge much rounded, and is much broader than long. Inside that there is a little plate, which may be considered as a rudimentary dorsal plate; it is in contact with the outer one of that series of scales which separates the radial shields. At the base of the arm there is on each side one rather large and a few small scales. The arm is not very high, oval in cross section. The joints are somewhat nodose, constricted at their inner, thickened at their outer end.

The disk is covered with large, flat, partly overlapping scales, among which only a few small ones are seen. The primary plates are very conspicuous. The central plate is five-sided with an angle to each radius, each side joined by an elongated, rounded scale. The radial shields widely sepa-

rated, almost oval, not half the length of the radius of the disk. In the interbrachial spaces there are a median row of larger scales and some smaller ones on each side. Ventral side of the disk covered with scales similar to those on the dorsal side. The edge of the disk rather sharp. Genital scale indistinct, very narrow, reaching scarcely to the end of the second joint. Genital slit short, reaching only to the end of the first joint.

Two well developed arm spines, the upper one as long as or a little longer than an arm-joint; farther out not quite so long as a joint; the lower one a little shorter. The two inner arm-joints have no spines. One large, rounded tentacle scale on the outer side of the pore; the first to third pair of pores mostly have one or two indistinct scales at the inner side (on the ventral plate).

Color in alcohol: white.

Several specimens from Stations 3362, 1175 fathoms; 3363, 978 f.; 3366, 1067 f.; 3371, 770 f.; 3400, 1322 f.; 3413, 1360 f.

Only unimportant variations to be noticed. The teeth sometimes are serrate in outline, and the same may be the case with the infradental mouth papilla. The mouth shield may be more rounded and a little longer. The ventral plates in some specimens are in contact till the 9th or 10th joint; in younger ones they are so only on the first joints. The central plate sometimes is almost round; the genital slits are often very indistinct, much shorter than first arm-joint. Sometimes, but rarely, there is an arm-spine on the second joint, but then only on one side of the arm, and not on all arms of the specimen.

This species is very closely related to *O. depressa* Lym., but is not very difficult to distinguish from the latter. The mouth shield, side mouth shields, and ventral plates are of somewhat different shape, which will be seen when comparing the figures of the two species; the same is the case with the disk scaling. The primary plates have a little central boss or tubercle in *O. depressa;* in *O. alba* it is very indistinct, or not at all present. The arm-spines are equally long, half as long as a joint in *O. depressa;* in *O. alba* they are about as long as a joint on the inner part of the arm; farther out shorter, only half the length of a joint. Usually the upper one is the longest, but sometimes the lower one is so, sometimes they are equal. All the pores have only one tentacle scale in *O. depressa;* the inner first to third pairs of pores have two (three) tentacle scales in *O. alba.* This character seems to be of most importance; however, it might well be that also in

O. depressa there are really two tentacle scales at the inner pores. Often the outer tentacle scale in *O. alba* wholly covered the inner, which then could only be seen when the former was removed. It may be that they will turn out to be the same species; at present we dare not declare them to be so.

(*O. depressa* was taken near the Philippines, in 500 fathoms.)

5. Ophiernus seminudus n. sp.

Plate V. Figs. 10-12.

Diameter of disk, 20 mm.; width of arm close to disk, 3.5 mm.; length of arms, c. 5 times the diameter of the disk. Nine mouth papillæ to each side of the mouth angle; the three outer ones are on the side mouth shields, and on the first ventral plate; they must be considered as the papillæ of the second mouth tentacle; the middle one of these is especially large, rounded. The rest of the papillæ are short, square, close set. At the apex of jaw, below the teeth, there are sometimes two or three small conical papillæ, sometimes none. Some specimens have the inner mouth papillæ pointed and longer than the outer ones; on the apex there also may be two rather large conical papillæ, or only one larger of the same form as the teeth; these are five in number, long, pointed, lanceolate. Mouth shield more broad than long, 1.5 : 1, with an obtuse angle within and outer edge straight, the sides strongly produced, rounded. Side mouth shields rather broad, meeting within.

First ventral plate hexagonal; the rest of the ventral plates with inner end truncated, outer edge curved; lateral sides, both inner and outer part, re-enteringly curved, the latter on account of the tentacle pores. They are a little broader than long, all in mutual contact. Farther out the proximal part of the ventral plates becomes narrow and rather long, stalk-like. There is a rather distinct keel along the median line of the ventral plates. The side arm-plates do not meet either below or above; their outer edge is not prominent. Dorsal plates twice as broad as long, feebly keeled, with inner edge a little concave, outer edge correspondingly rounded, lateral sides straight; they are broadly in contact, the inner edge being inconsiderably narrower than the outer edge. Far out on the arm they become somewhat longer and narrower. The four to six first dorsal plates are more or less rudimentary; the sides of the arms along these rudimentary plates are

naked. The arms are not wider outside the disk than on the part enclosed in the disk; they are rather high, rounded, triangular in cross section.

The central part of the disk is covered with a naked skin, in which only some few very small, widely spread plates are seen (in dried specimens). Along the margin the disk is covered with small, irregular, but distinct scales, which are also found along the margin of the radial shields. These are rather large and conspicuous, almost as long as half the radius of the disk; they are oval in outline, only the outer edge is almost straight. Usually they are widely separated by several rows of scales, sometimes only by one row of rather large scales. No marginal plate in the interbrachial space, and of course no primary plates. The whole under side of the disk covered with very small overlapping scales. Sometimes there are a few grains on the disk, especially round the radial shields. No genital scales distinct, no papillæ along the large genital slits, which reach to the margin of the disk.

Only two very short arm-spines, sometimes three, in the inner part of the arm, and farther out only one; the upper one is usually a little longer than the other. They are not inserted on the outer edge of the side arm-plates, but a little below, on a little elevation; they only reach to the outer edge of the side plate. The tentacle pores are large, and very conspicuous; the first 4–5 pairs have two papillæ at the distal edge, one wide and flat, the other short, rounded. Farther out there are two rather elongated, pointed scales at the proximal edge of the pore, and these continue in the whole length of the arm.

Color in alcohol: gray, with a bluish tint.

Several specimens from Stations 3360, 1672 fathoms; 3398, 1573 f.; 3399, 1740 f.; 3400, 1322 f.; 3414, 2232 f.

This species is very variable as to the form of the plates, especially mouth and side mouth shields; it is rare to see them so regular as in the figure, which however must be regarded as the typical form. Often they are broken or quite irregular in outline. This is no doubt due to the feeble calcification. One specimen has two–three small papillæ at the outer edge of the radial shields, as a rudimentary arm-comb.

O. seminudus is very closely related to *O. vallincola* Lym., and perhaps it is really the same species. Judging from the figures given by Lyman (Challenger, V., Plate XXIV. Figs. 16–18), they are not identical: the mouth papillæ, mouth shield, side mouth shields, first ventral plate, the inner dorsal

plates, the granular covering of the disk and the three arm-spines being all different. On closer examination, however, none of them are very solid.

The mouth papillæ are not quite in accordance with LYMAN's description, so they had better be disregarded. As a whole they seem to have no specific importance in this genus. Mouth shield and side mouth shields are very different from the same parts in our figure of *O. seminudus;* but there is so much variation among the specimens that there cannot be much weight given to this; thus, the side mouth-shields may have the same form as those in LYMAN's figure of *O. vallincola*. In the mouth shield there may be found a distinct character; in *O. seminudus* there is always a restriction at the outer edge; in *O. vallincola* that seems not to be the case. The first ventral plate is of rather different shape, but in many of our specimens its form is quite indistinct. The inner dorsal plates are not rudimentary in *O. vallincola*, but in *O. seminudus* this feature is not always so prominent as in the specimen figured, however always distinct. It may further be remarked that the naked space is seen distinctly only in dried specimens. The granular covering was wholly wanting in many of LYMAN's specimens of *O. vallincola;* in *O. seminudus* it is only very scarce in some few specimens; most of them are quite naked. *O. vallincola* has three arm-spines in the same place as and similar to those in *O. seminudus*, which has commonly two, except at the inner joints; but sometimes also the latter has three arm-spines to about the middle of the arm. Finally, the outline of the disk is different in the two species. The large angular plates seen along the genital slits in LYMAN's figure of *O. vallincola* are the genital organ's, seen through the skin; the like was also seen in *O. seminudus*. We think it best to make a separate species of this Pacific form, as there seems not to be sufficient evidence that it is identical with the Atlantic form. But certainly they must be very closely related.

6. Ophiernus annectens n. sp.

Plate V. Figs. 4-6.

Diameter of disk, 13 mm.; width of arm close to disk, 3 mm.; length of arms about seven times the diameter of the disk. Eight to ten mouth papillæ to each side, the three or four inner ones conical, the outer rounded or square. The two at the apex mostly longer than the rest, but here much variation exists: sometimes there are more short and broad papillæ, quite

irregularly placed, sometimes three rather large. The four to five teeth are long, rounded, almost club-shaped, different from those in *O. seminudus*. Mouth shield a little longer than wide, with a restriction at the outer end, which thus looks almost like a little stalk. Side mouth shields rather long, much broader without than within, where they just meet.

First ventral plate of the same form as those beyond; they are as long as broad, with outer edge curved, inner end truncated; both inner and outer laterals deeply re-enteringly curved, the latter on account of the tentacle pores. The inner end of the ventral plates, especially of those farther out on the arm, looks like a short stalk, and is somewhat elevated, making a keel along the median line of the arm. The ventral plates are all in mutual contact and of the same form in the whole length of the arm. The side arm-plates very broad and flat, with outer edge sharp, rounded in outline; from the tentacle pore to the margin of the arm runs a slight elevation, parallel to the outer edge of the side-plate; at the outer end of this elevation the arm-spines are inserted. The dorsal plates are widely in contact in the whole length of the arm; they are more than twice as broad as long, with a feeble keel. Inner and outer edge curved, the former concave, the latter convex; the lateral sides straight. Outer edge a little wider than the inner edge. One or two of the inner dorsal plates mostly a little narrower than the rest, and there is then a little naked space at each side of them. The arm is very flat and wide, lenticular in cross section. The arm-joints enclosed in the disk are narrower than the first free joints; farther out the arm again becomes narrower. The inner part of the arm (3–4 first joints) rather deeply hollowed in the median line.

The disk is wholly covered: the inner part by a close granulation, beneath which there are some indistinct scales, the outer part by the radial shields and distinct small scales, the latter mostly covered with grains. The naked radial shields are widely separated by one or more irregular rows of scales; they have the form of an almost rectangular triangle, about as long as half the radius of the disk. In the interbrachial spaces the disk widens a little, outside the radial shields. No marginal or primary plates. The ventral side of the disk is covered on the outer part with rather distinct, overlapping scales, on the inner part with a close granulation, beneath which the skin is almost naked. No genital scales distinct, no papillæ along the wide genital slits, which reach to the margin of the disk.

Two arm-spines: the upper one about as long as a joint, the lower not

half so long. They are inserted close together at the side edge of the arm, not at the outer edge of the side arm-plates. The three inner pairs of tentacle pores with one wide and two small papillæ at the distal edge; from the fourth to the end of the arm there are two distinct elongated scales at the proximal edge.

Color in alcohol: gray, with a bluish tint, arms white.

39 specimens from Station 3402, 421 f., most of them not well preserved. Only unimportant variations to be noticed.

This species is very closely related to *O. adspersus* Lym., perhaps really the same species; however, as with *O. seminudus* and *O. vallincola*, it seems to us best to keep them separate for the present. There are only small differences to be noticed. The mouth shield is a little different in form, and the side mouth shields are separated within in *O. adspersus*, meeting in *O. annectens*. But there cannot be much weight given to this, as the mouth region shows considerable variation in this genus. First ventral plate is swollen in *O. adspersus*, not in *O. annectens*. The most important difference, however, is found in the radial shields; in *O. adspersus* their inner end is covered with grains, in *O. annectens* they are quite naked, also their form is somewhat different; and the radial shields are of importance as to the specific differences in this genus. The arm-spines are somewhat longer in *O. annectens* than in *O. adspersus;* the upper one about as long as a joint in the former, only half that length in the latter. In other respects they are entirely alike. It seems then quite possible to distinguish these two forms, but they are very closely related.

It is interesting thus to find in the Pacific two species of *Ophiernus* corresponding to the two Atlantic species. A third species from the Atlantic, *O. abyssalis*, was described by KOEHLER (66) and further (67) recorded from the Indian Ocean, where also *O. vallincola* was found (LYMAN). A third species is also found in the Pacific, but this species and *O. abyssalis* do not seem to be closer related to each other, or to any of the other known species.

7. Ophiernus polyporus n. sp.

Plate V. Figs. 7-9.

Diameter of disk, 14 mm.; width of arm close to disk, 4.5 mm.; length of arms unknown, but certainly about as in *O. annectens*. Ten (9–11) mouth papillæ on each side of the mouth angle; the outer ones being really the

scales of the second mouth tentacle; the inner ones are pointed, conical, the outer rounded; usually two, sometimes only one at the apex, below the long club-shaped teeth, which are four or five in number. Mouth shield triangular, with outer end restricted, looking like a short stalk; corners rounded; a little longer than broad. Side mouth shields much broader without than within, where they meet.

First ventral plate indistinct, those beyond a little longer than wide, with outer edge curved and inner end truncated. The lateral sides much restricted: the outer part by the tentacle pores, the inner part by another pair of pores, which give the ventral side of the arm a very curious appearance. By these two pairs of pores to each joint the ventral plates are so restricted as to appear like a narrow median band along the under side of the arm. Farther out on the arm these pores become smaller, and from about the middle of the arm they wholly disappear. The side arm-plates do not meet either below or above; they are very wide, with outer edge sharp, finely curved in outline. From the tentacle pore to the margin of the arm there is a slight elevation, parallel to the outer edge of the plate. At the outer end of this elevation the arm-spines are inserted. The dorsal plates are more than twice as long as broad, with outer edge a little wider than inner edge, both slightly curved; lateral sides straight. They have a feeble keel. The three or four inner ones more or less rudimentary, with a naked space on each side. The arms are very wide, flat, triangular in section; their under side is deeply hollowed in the median line in the inner part, farther out it is flat. The joints enclosed in the disk are considerably narrower than those outside the disk; farther out the arm gradually becomes narrower again.

The dorsal side of the disk is covered almost wholly by the large naked radial shields, which are as long as three fourths of the radius of the disk; the little central space is covered with a close granulation, beneath which no scales are seen. The radial shields are in contact in their whole length, or partly separated by a row of very small scales; in the interbrachial spaces they also are in contact, only sometimes separated by a narrow line of granulæ. Their abradial margin is covered with some indistinct scales, which are again covered with granulæ. The outer edge is doubly curved, and the outer corner is somewhat produced outwards. Outside that there are again some mostly naked scales; the disk is thus considerably produced in each interbrachial space. Under side of the disk covered along the margin and the genital slits with very indistinct small scales; in the middle part

there are no scales, the skin is covered only with granulæ. No distinct genital scales.

Two sharp, pointed arm-spines, at the edge of the arm; the uppermost about as long as a joint, the lower much shorter. The three to four inner tentacle pores with a broad and a small papilla along the distal edge of the pore, those beyond with two rather large scales of the common form at the proximal edge.

Color in alcohol: gray, the radial shields usually with the margin white.

Several specimens from Stations 3356, 546 f.; 3418, 660 f.; 3424, 676 f.; 3425, 680 f.

The sole specimen from the latter station has the pores much smaller than usual. The significance of these pores is quite unknown to us; they would best be examined on sections of the arm, but the specimens are too badly preserved to be used for histological researches. The pores seem not to be covered with skin. In a single specimen of *O. annectens* we have found some few small pores and depressions, corresponding to the pores in *O. polyporus*.

GYMNOPHIURA n. g.

This genus is closely related to *Ophioglypha*, the sole important difference being that the dorsal side of the disk is covered with a thick naked skin, in or beneath which only a few, if any, irregular widely spread scales are hidden. In younger specimens these scales may be somewhat more distinct. The outer ends of the radial shields are naked. In all other respects, mouth papillæ, teeth, tentacle pores, arm-comb, etc., it closely resembles *Ophioglypha*. As that genus already in its present limitation is rather too wide, it seems to us perfectly justifiable to constitute a new genus on this form. From the genus *Ophiopleura*, whose disk is also covered with a thick skin, it is well separated; *Ophiopleura* has short genital slits, which do not reach the margin of the disk; there is a complete covering of small distinct scales beneath the skin, and there is no arm-comb.

8. Gymnophiura mollis n. sp.

Plate VII. Figs. 7-9.

Diameter of disk, 25 mm.; width of arms close to disk, 5.5 mm.; length of arms about five times the diameter of the disk. Five or six mouth papillæ to

each side, short, rounded, rather close set; the outermost one is wider than the rest, and separates the pore of the mouth tentacle from the mouth space; that on the apex of the jaw is scarcely longer than the rest. Mouth shield hourglass-shaped; an obtuse angle within, outer edge straight, lateral sides deeply restricted by the inner end of the genital slits; the corners rounded. Side mouth shields rather short, almost equally wide in their whole length, meeting within. Mouth angle not prolonged.

First ventral plate not much smaller than the following ones, polygonal, with outer edge strongly curved, inner edge straight. The following ventral plates a little broader than long; the second is longer than the rest, though not so long as broad. Inner and outer edge are strongly curved, the former concave, the latter convex. The lateral sides a little re-enteringly curved through the tentacle pores. The five inner ventral plates are in mutual contact in their whole breadth; from the sixth, the piece in contact becomes rapidly narrower, and from the 8th–9th joint they are wholly separated. Their form then rapidly alters: at first they have an acute angle within, but this soon disappears; they have then a slightly rounded edge within, whereas the outer side is produced into an angle, with the tip rounded. The plates are thus triangular, with the top turned outward, and lie almost wholly in the base of the next joint, not in that to which they really belong; in this form they continue to the end of the arm. The side arm-plates are flat, straight, outer edge not prominent; on the dorsal side they are separated to the end of the arm. The dorsal plates are four-sided, in the inner part of the arm twice (or more) as broad as long, farther out they gradually become narrower, and towards the end of the arm they are twice as long as broad. They are in contact in their whole width, the inner edge being only inconsiderably narrower than the outer. All the sides are almost straight. The first three dorsal plates are of a somewhat different shape: the first is crescent-shaped, convex within, concave without; the second has inner and outer edge straight, the latter the widest; the third has inner edge straight or slightly concave, outer edge convex; this is the widest of all the dorsal plates. The three described plates are very short; along their sides is a somewhat elevated line, which bears some small, not very distinct papillæ, the secondary arm-comb. Inside these three plates there are yet one or two very small rudimentary dorsal plates. Arms thick and round.

Disk covered with a thick naked skin, through which only the radial

shields are seen as large ribs. They are long, narrow, widely separated; their outer third part is naked and smooth, the rest is covered (beneath the skin) with irregular scales, which are firmly united with them, their surface thus being rough. The outer edge of the radial shields is straight, sharply cut. Some spread scales are found between the radial shields, especially at their outer end. For the rest, only some few small, irregular widely spread scales may be seen in the skin of the disk, and they can only be seen in dried specimens. The ventral side of the disk is covered with rather distinct overlapping scales, which are not enveloped in thick skin. Genital slits very wide and long, reaching almost to the dorsal side of the arm. The genital scale is distinct only towards the margin, grows rather broad as it passes to the dorsal side, where it bears the arm-comb, which consists of short rounded papillæ; about eight to ten are to be seen from above. The genital papillæ short, conical.

Seven to eight short, equally spaced arm-spines Tentacle pores large in the inner part of the arm, but soon diminishing in size, distinct only to about the middle of the arm. First tentacle pore seemingly opening into the mouth space, but separated therefrom by the outermost mouth papilla. Numerous long tentacle scales. First pair of pores has 5–6 on inner (adradial), 6–8 on outer (abradial) side; the second has 4 on inner, 6–7 on outer side. They are then gradually reduced in number; on the 9th–10th pore there are no more scales on the inner side; those on the outer side are reduced to a very small one at about the 20th joint, and this one continues to the end of the arm.

Among the numerous large specimens but little variation is found. At the apex of the jaw there may be some more mouth papillæ, irregularly crowded, so as to resemble tooth papillæ, but they are not so really. The secondary arm-comb is often wanting, and often it is only one or two of the first dorsal plates, which are of another shape than the rest. The number of arm-spines varies not a little; the typical number is 7–8, but it may be reduced to 5, or raised to 9 or 10.

In younger specimens (diameter of disk, 13 mm.) there is a rather complete covering of plates on the dorsal side of the disk, under the skin, but the scales are very irregular and indistinct in outline; a central plate is distinct, also five other primary plates, which lie between the inner ends of the radial shields. In still younger specimens presumably the primary plates will be large and cover most of the disk. Only the first dorsal plate

has a shape different from that of the rest. Not so many tentacle scales as in larger specimens; five arm-spines. No distinct secondary arm-comb.

Color in alcohol: gray, with a faintly bluish tint on the skin; the radial shields appear as white lines. In dried specimens the naked skin is almost black.

Stations 3392, 1270 f.; 3400, 1322 f.; 3413, 1360 f.

9. Gymnophiura cœrulescens n. sp.

Plate VII. Figs. 4–6.

Diameter of disk, 21 mm.; width of arm close to disk (without spines), 5 mm.; length of arms unknown, but evidently as in *G. mollis*. Six (5–7) short, not very close set, more or less conical mouth papillæ, one longer at the apex. The outermost papilla does not separate the first tentacle pore from the mouth space. Mouth shield a little longer than broad, with a very obtuse angle (or rounded) within and outer edge rounded; the lateral sides restricted at the inner end, then straight until the outer edge; the inner part of the mouth shield is thus broader than the outer part; sometimes it is quite irregular in outline. Side mouth shields rather short, equally broad without and within, sometimes meeting within, sometimes more or less widely separated by a naked space.

First ventral plate a little smaller than the following, with the sides rounded, inner edge straight, outer edge curved inward; in other specimens it is more hexagonal, with outer edge straight; sometimes it is divided by a median line. The following ventral plates are about twice as broad as long; they are in mutual contact until the c. 8th joint, the piece in contact becoming gradually narrower. The outer edge is almost straight, only with a little rounded peak in the median line; the inner edge straight on the inner plates; the lateral sides slightly sigmoidly curved, making an angle of about 45° with the longitudinal axis of the arm. The outer edge is much broader than the inner edge. From the c. 9th joint there is an angle within, but that gradually disappears farther out, and the whole inner side of the ventral plate is then rounded or almost straight, the plate being thus very short but broad. Side arm-plates with outer edge a little prominent; they seem to be widely separated above to the end of the arm. The dorsal plates more than twice as broad as long, becoming gradually longer and narrower farther out on the arm; they have a feeble keel. Outer and inner

edges double curved, the former convex, the latter concave, lateral sides straight; outer edge a little wider than the inner edge. The first three or four dorsal plates more or less rudimentary, with a naked space at the sides. No distinct incisure in the disk at the arm-basis. Arms very wide and flat, slightly rounded below, with a keel above.

Dorsal side of the disk rather curious looking: there is a little naked central space, which in each radius and interradius is prolonged towards the margin, thus taking the form of a star. A broad band along the margin is covered with small, but rather distinct, overlapping scales, which also cover the inward prolongations between the rays of the naked central space. Radial shields very small, triangular, with outer edge curved, widely separated. Under side of the disk also covered with small, distinct, overlapping scales. Genital scales distinct only in their outer part, where they pass to the dorsal side of the arm; here they appear as a rounded plate, bearing an arm-comb, which consists of 6–8 very long and thin pointed papillæ. Genital papillæ also long and needle-like.

Three well developed pointed arm-spines, the lowermost one about as long as an arm-joint, the two upper ones about as long as two joints. The tentacle pores seem to be distinct in the whole length of the arm; first pair opens into the mouth slit. Only on the first joints the pores are in contact with the outer corners of the ventral plate; farther out they are distinctly separated from it. (In *G. mollis* the pores lie along the sides of the ventral plates.) Tentacle scales rather numerous, long and flat; first pair of pores has 4–5 on each side; those on the inner side already have disappeared from the c. 6th joint; those on the outer side diminish in number: from the c. 9th joint three, from the c. 12th two, and from the c. 20th only one scale, which seems to continue to the end of the arm.

Color in alcohol: gray, with a distinct bluish tint, especially on the naked parts of the disk.

Five large specimens from Station 3431, 995 f.; from Station 3429, 919 f.; there are some broken arms of this species.

The two species of *Gymnophiura* here described are not very closely related, and might even be regarded as types of two subgenera; however, before more species of this genus are known, such subdivision is not needed. *Ophioglypha inermis* Lym. possibly is nearly related to *G. cærulescens*. Of this species LYMAN says (Challenger, p. 12) that it "stands on the limit of *Ophioglypha*." If it should turn out to belong to the genus *Gymnophiura*,

the definition of this genus must be somewhat altered, as it has the disk wholly covered with thin scales; or perhaps *G. cœrulescens* should be referred to *Ophioglypha* together with *O. inermis*, and *G. mollis* alone remain in the genus *Gymnophiura*. For the present, we are unable to say anything about it definitely.

10. Ophioglypha superba n. sp.

Plate I. Figs. 4-8. Plate VII. Fig. 4.

Diameter of disk, 25 mm.; width of arm close to disk, 5.6 mm.; length of arms, c. 100 mm. Three or four short mouth papillæ on each side, close set, rounded; that on the apex of jaw mostly concealed by the innermost papillæ on the sides. Mouth angles rather long. Mouth shield very prominent, thick, inner end narrow, with an angle; outer end broad, rounded, bending towards the dorsal side; a little longer than broad. Side mouth shields short, rather broad, meeting within.

Ventral plates in close contact in their whole breadth on the first c. 10 joints, separated only from the c. 15th joint; their form is almost regular hexagonal, with inner and outer side longest. Farther out on the arm they have an angle within and outer edge curved. They are broader than long. The inner ones are somewhat hollowed, almost saddle-shaped, the outer ones flat. Side arm-plates short, rounded, meeting below from about the 15th joint, separated above almost to the end of the arm. Dorsal plates almost of the same shape as the ventral, on the inner part of the arm, farther out more elongated; they are broadly in contact. The first 4–5 thick and swollen; in the rather deep incisure of the disk there are seen one or two rudimentary dorsal plates. The arms are very thick and high.

The disk is covered with large, thick, swollen polygonal plates, among which the primary plates are not conspicuous. The radial shields rather large, with a notch on their outer end; they are in contact in most of their length, only their inner part being separated by an elongated plate. No great marginal plate in the interbrachial spaces. Under side of the disk bending towards the dorsal side, the edge of the disk being very high and abrupt (Fig. 6), covered by several thick plates and by the large genital plates, which, especially at the upper side of the arm, form a pair of conspicuous plates outside the radial shields, bearing the well developed arm-

comb. The papillæ along the genital slits, which begin at the inner end of the mouth shield, are short, close set, square, almost as large as the papillæ of the arm-comb; c. 8 papillæ to be seen from above (Figure 5 shows a little too many). Often some of the papillæ are smaller than the others (regenerated?), Figure 7. There is a secondary arm-comb (Plate VII. Fig. 4), consisting of a row of papillæ along the upper part of the outer edge of first side arm-plate, (that is to say the first which reaches the dorsal side of the arm,) and on a little supplementary plate, which lies at the upper end of this side plate.

Four quite rudimentary, equally spaced arm-spines. Tentacle pores large, distinct to the end of the arm, first pair opening into the mouth space. Numerous tentacle scales: the first pore with five to six on the outer (abradial), four to five on the inner (adradial) side; second to third pore with four to five on outer, four on inner side; fourth pore with four to five on outer, three on inner side; fifth to eighth with four to five on outer, two on inner side; ninth to about the fifteenth with three to four on outer, one on inner side. From this point there are no papillæ on inner side, two or three on outer side, and these continue to the end of the arm. The outermost of the papillæ on the inner side is larger than the others; of those on the outer side the same is the case with the first pore; on the second pore the innermost papilla is the largest, and from the third pore they are almost all equally large. The direction of the pores gradually alters farther out on the arm: on the inner part they are at an angle of c. 45° with the longitudinal axis of the arm, farther out they are at right angles with it.

Color in alcohol: grayish white.

Stations: 3431, 995 f., 5 large specimens; 3419, 772 f., 1 large specimen.

11. Ophioglypha abcisa n. sp.

Plate II. Figs. 1-3. Plate V. Fig. 3.

Diameter of disk, 7 mm.; width of arm close to disk, 1.4 mm.; length of arms unknown, as they are broken in all the specimens at hand. Five short, square, close set mouth papillæ on each side of the mouth angle, one pointed on the apex of jaw. Mouth shield large, with an acute angle within, outer edge rounded, lateral sides restricted; the outer part is much broader than the inner part; a little longer than broad. Side mouth shields very long and narrow, meeting within.

The first three ventral plates in contact, those beyond widely separated; all with outer edge rounded. First ventral plate triangular, almost as large as the next one; second and third with inner end truncated, the rest with an angle within; lateral sides re-enteringly curved. The whole under side of the arm rounded. Side arm-plates long and almost straight, meeting below from the third, above from the second (free) joint. Dorsal plates triangular, with all three sides a little curved. Between the papillæ of the arm-comb are seen one or two very small dorsal plates, and one larger with inner end truncated.

The disk is covered with rather large, irregular, overlapping scales, among which the primary plates are not very distinct. Radial shields not much larger than the other scales, meeting broadly without, the one overlapping the other; inner ends separated by one or two scales. In the interbrachial spaces there are two great scales, which connect the radial shields of each two adjoining arms; at the margin of the disk there are more small scales. The margin of the disk very high and abrupt, no sharp edge between ventral and dorsal side. The ventral side of the disk covered almost by the mouth shield alone. Genital scale large, growing gradually broader outwards, where it passes to the dorsal side of the arm; here it makes a conspicuous plate outside the radial shield, bearing the arm-comb. Papillæ along the genital slits short, square, and close set; at the sides of the arm they gradually become long and pointed, and make then a very well developed arm-comb; 8–10 papillæ visible from above. There is a secondary arm-comb, consisting of shorter pointed papillæ, inserted on a little supplementary plate at the upper end of first side arm-plate, which reaches the dorsal side of the arm (Plate V. Fig. 3).

Three, on the first (free) joints four, equal, evenly spaced, rudimentary arm-spines. Tentacle pores large, distinct in the whole length of the arm, as far as can be judged from specimens with broken arms. First pore not opening into the mouth space. Tentacle scales: first pore with two or three on each side; second and third, with three on each side; fourth, with two or three on outer, two on inner side; fifth, with one on each side; the following with only one scale, on the outer side.

Color in alcohol: gray.

Seven almost equally large specimens, from Station 3370, 134 f.

The other specimens differ very little from the one described. Only the number of tentacle scales is somewhat variable, there being often 4–5 papillæ on the inner side of the second to fourth pore.

12. Ophioglypha obtecta n. sp.

Plate II. Figs. 7-9.

Diameter of disk, 6 mm.; width of arm close to disk, 1.8 mm.; length of arms, c. 25 mm. (the ends broken off). Four short, close set mouth papillæ to each side of mouth angle, the outermost very broad, the innermost pointed, as is that on the apex of jaw. Mouth shield hourglass-shaped, with an obtuse angle within, outer edge rounded; longer than broad. Side mouth shields long, narrow, equally broad, meeting within.

Ventral plates separated from the fifth, the four inner ones more or less broadly in contact. First ventral plate with outer edge strongly rounded and with a truncated peak within; not much smaller than the next ones. They have all the outer edge rounded; second to fourth (fifth), with inner end truncated: from the fifth they have an angle within. Inner and outer laterals re-enteringly curved, the latter on account of the tentacle pores. The three or four first plates are somewhat hollowed along the median line. Side arm-plates with outer end a little prominent, meeting below from the 4th joint, above only from about the 14th. Dorsal plates rectangular, the innermost as broad as long, becoming gradually narrower farther out; from the 13th–14th joint they are triangular, with a very acute angle within, and from here they are separated by the side arm-plates. The sides of these rectangular plates are a little concave.

Disk scaling rather peculiar: the primary plates are round and thick, and between them there are small, very indistinct scales. Radial shields conspicuous, almost egg-shaped, meeting in their middle part, separated within by the disk scales, without by the two first rudimentary dorsal arm-plates. No great marginal plate in the interbrachial spaces. Ventral side of the disk almost wholly covered by the mouth shields, only a few small scales besides that; the margin of the disk is very high and rather abrupt, without any sharp edge between ventral and dorsal sides, covered by small scales. Genital scales rather large, especially their outer end, which passes to the dorsal side of the arm. The papillæ along the genital slits are few and very small, rounded; as they pass to the dorsal side of the arm they become longer and pointed, making a well developed arm-comb, of which 6–7 papillæ are seen from above. The edge of the genital plate is here delicately furrowed. No secondary arm-comb.

Three equal, evenly spaced, rudimentary arm-spines. Tentacle pores large, distinct to the 16th–20th joint, presumably continuing to the end of the arm. First pore not opening into the mouth space. Tentacle scales: first to fourth pore with two on each side; fifth and sixth with two on outer, one on inner side; from the sixth or seventh there are none on the inner side, two on the outer side, and from the ninth or tenth there is only one on the outer side.

Color in alcohol: gray.

Only three specimens: that described from Station 3400, 1322 f.; further one from Station 3375, 1201 f.; and one from Station 3413, 1360 f.

The last two specimens are larger: diameter of disk, 10 mm. Side arm-plates meeting below only from the sixth joint, On one specimen the scaling on the margin of the disk is rather incomplete, naked spaces being seen between the scales. The other has 5–6 mouth papillæ; first tentacle pore has generally three scales on each side, the other pores as above described, only that the scale on the inner side may continue farther out. Upon the whole the three specimens differ very little from one another.

13. Ophioglypha tumulosa n. sp.

Plate I. Figs. 9-13.

Diameter of disk, 31 mm.; width of arm close to disk, 6 mm.; length of arms c. 5 times the diameter of the disk. Eight short, close set mouth papillæ on each side, the two outermost rather broad, the two innermost conical; one pointed at the apex of jaw. Mouth shield almost square, an obtuse angle within, outer and lateral sides straight, the corners rounded. Side mouth shields long, narrow, meeting within.

First ventral plate almost oval, though with an angle on each side. The form of the following plates rather complicated. The second to third are polygonal, wider without than within. The second has the outer edge straight or a little concave; on the third it is convex. From here the ventral plates gradually take the form seen in Figure 12. Farther out they become triangular, with an angle within, outer edge rounded, partly with a little peak in the median line, lateral sides faintly sigmoidly curved. The first two are broadly in contact; from the third, the part in contact becomes narrower, and from the 7th to 10th joint they are separated. The side arm-plates are almost straight, outer edge somewhat prominent, on large

specimens, not on the small ones; they are widely separated above almost to the end of the arm. The dorsal plates are short and very broad, roof-shaped, outer edge somewhat concave; they are in contact in almost their whole breadth; farther out they become narrower, more elongated. In the rather deep incisure of the disk are seen 3–4 dorsal plates, not very rudimentary. The arms are very high on the dorsal side, flat on the ventral side, almost triangular in cross section.

Disk covered with rather small, but thick and swollen scales; on the central part only some few of the scales are swollen, towards the margin they are all so. Primary plates inconspicuous. Radial shields rather small, but also thick and swollen, therefore very conspicuous; they are almost egg-shaped, widely separated by several irregularly arranged thick scales. No large marginal plate in the interbrachial spaces. Ventral side of the disk covered with similar thick scales, though not quite so large as those on the dorsal side. Edge of the disk rounded. Genital plates small, distinct only at the outer part of the disk; they do not extend far upwards to the dorsal side of the arm, only to the outer corner of the radial shields; the arm-comb therefore is very inconspicuous, far from reaching the median line at the arm-basis; only 4–5 papillæ to be seen from the dorsal side. Papillæ along the genital slits well developed, close set; at the inner end of the slits they are irregularly pointed, farther out they become more square, as are the papillæ of the arm-comb. Usually they are somewhat thickened at their basis. There is no secondary arm-comb, though sometimes there are one or two small papillæ between the end of the side arm-plate and the dorsal plate.

Three small arm-spines, the two lower ones rather close together, the upper one apart, not distinctly longer than the other. The outer edge of the side arm-plate is somewhat curved outwards between the two upper spines; Figure 13 does not give that well. Tentacle pores of the inner part of the arm large and conspicuous, farther out they rapidly diminish in size; from c. 10th joint they are quite rudimentary (or wanting), but one tentacle scale continues almost to the end of the arm. First pair of pores apparently opening into the mouth space, but in fact it is separated from it by the outermost mouth papillæ; c. 8 tentacle scales on each side. The second pair has 5–6 on inner, 6–7 on outer side, and then the number of scales gradually diminishes; from about the tenth joint there is only one scale on the outer side, none on the inner side.

At the outer end of each pore there lies a little but distinct plate, which

connects the ventral plate with the side arm-plates of the same joint, outside the pore (Fig. 12). Also at the first pore this plate is found, but here it lies proximally to the ventral plate and usually bears the two outermost tentacle scales at the inner side of this pore (not sufficiently clear in Figure 9). This plate is distinct only to about the 10th joint, diminishing in size at the same rate as the pores. Perhaps it is to be looked at as a modified tentacle scale. This plate is found also in *Ophioglypha plana*.

Color in alcohol: pale gray.

Younger specimens — (Figs. 9, 10), diameter of disk, 12 mm.; width of arms close to disk, 2.5 mm. — differ from the full grown specimens in not having the scales thick and swollen, but rather flat and small, irregular polygonal or rounded, overlapping. The primary plates are distinct, also a marginal plate; the radial shields are somewhat more elongated, though mainly of the same shape as in other specimens. Mouth papillæ almost equally large, only the innermost one on each side pointed. The innermost ventral plates not quite so broadly in contact, nor always so many of them in contact. Besides these no differences of importance are found.

The numerous specimens vary rather widely, especially in the covering of the disk. There are large specimens with the disk scales perfectly smooth, and there are small specimens with thick swollen scales. The radial shields sometimes only just meet at their outer end. The ventral plates sometimes are separated from the fourth joint in large specimens. The arm-spines are often a little longer on the joints in the disk than on those farther out. One specimen (Station 3432) has the arm-spines more developed than usual.

Stations 3360, 1672 f.; 3362, 1175 f.; 3366, 1067 f.; 3375, 1201 f.; 3376, 1132 f.; 3381, 1772 f.; 3392, 1270 f.; 3398, 1573 f.; 3399, 1740 f.; 3400, 1322 f.; 3413, 1360 f.; 3414, 2232 f.; 3432, 1421 f.

The description of this species somewhat recalls that of *O. grandis* Verrill (119); but as that species has not been figured it is impossible to say anything more definite about their possible relations.

14. Ophioglypha plana n. sp.

Plate III, Figs. 1–4.

Diameter of disk, 12 mm.; width of arm close to disk 2 mm.; length of arms, c. 60 mm. Five to six short mouth papillæ to each side, the outer-

most square, the innermost pointed; one a little larger on the apex of jaw. Mouth shield with an angle within, outer edge almost straight, outer corners rounded; the lateral sides are a little restricted by the genital slits; equally broad and long. Side mouth shields long and narrow, meeting within.

First ventral plate polygonal, as large as the following. Second to fourth (third) with inner end truncated, those farther out with an angle within; from the fifth (fourth) they are widely separated. Outer edge of the first three ventral plates much rounded, then it gradually becomes almost straight. Outer laterals straight (along the tentacle pores), inner laterals re-enteringly curved. Side arm-plates long and almost straight, meeting broadly below from the fourth joint, above from the fifth to sixth joint. Dorsal plates with outer edge much rounded, inner end truncated on the first 5–6 joints; from here they have an acute angle within, and are separated by the side arm-plates; the lateral sides are straight.

The disk is covered with coarser or finer overlapping scales, among which the primary plates are rather conspicuous, especially because they are of a darker color than the other scales; the network of the chalk substance is coarser than in the other scales. Radial shields not very large, separated within by one or more scales, meeting more or less broadly without, the one overlapping the other. Sometimes they are wholly separated (Fig. 2). Outer edge of the radial shields rather straight, there being almost no incisure at all in the disk at the base of the arm. In the interbrachial spaces there is usually an inconspicuous marginal plate. Ventral side of the disk covered with similar overlapping scales, among which none are conspicuous. Genital plate narrow, becoming a little broader as it passes to the dorsal side of the arm, where it bears the arm-comb, whose two parts almost or wholly meet in the median line over the arm-basis. The papillæ are rather short, more or less pointed, 6–9 to be seen from above. There is no secondary arm-comb. Papillæ along the genital slits small, close set, rounded. The dorsal side of the disk flat, the margin not rounding towards the ventral side, whereas the ventral side bends towards the dorsal side. There is, however, no sharp edge.

Three rather well developed arm-spines, the upper one the longest, the lowest one the shortest; especially on the first free arm-joints the uppermost spine is long, almost as long as the next joint; they are not quite equally spaced, the uppermost being a little apart from the other two. The tentacle pores are distinct in the greater part of the arm; the first pore

does not open into the mouth space. Tentacle scales: first pair of pores with 6–7 on inner, 8–9 on outer side; second with 5–6 on inner, 6–7 on outer side; and thus the number gradually diminishes; from the eighth pore none on the inner side, from about the twelfth only one on the outer side. At the distal end of the tentacle pore there is a small but distinct supplementary plate, which connects the outer corner of the ventral plate with the outer edge of the side arm-plate, as in *O. tumulosa.* At the first pore this plate is also to be seen, but here it lies proximally to the first ventral plate.

Color in alcohol: gray.

The numerous specimens differ very little from the one described. The number of tentacle scales is somewhat variable. One specimen had, at the first pore 3–4 on inner, 5–6 on outer side; at the second, only 2 on inner, 4 on outer side; from the seventh there was only one on the outer side. The mouth shield is sometimes almost without restriction on the lateral sides, and it then is almost the same as that in *O. tumulosa.* As a whole, these two species are very nearly related, but there is no great difficulty in distinguishing them: the incisure in the disk (including 2–3 rudimentary dorsal plates in *O. tumulosa,* almost wanting in *O. plana,* specimens of the same size being compared), the arm-comb (almost invisible from above in *O. tumulosa,* well developed, often continuous over the base of the arm in *O. plana*), the dorsal plates (in mutual contact until about the 20th joint in *O. tumulosa,* only to the 7th–9th joint in *O. plana*), giving sufficient characters. Of the specimens of *O. plana* none exceed the size of 15 mm. in diameter of disk, whereas *O. tumulosa* grows much larger.

In very small specimens (diameter of disk 4–5 mm.) the ventral and dorsal plates are separated from the second or third. A few small specimens had the inner angle of the mouth shield more acute than common. The upper arm-spine not always distinctly longer than the others in these small specimens.

Stations 3357, 782 f.; 3360, 1672 f.; 3361, 1471 f.; 3374, 1823 f.; 3376, 1132 f.; 3381, 1772 f.; 3392, 1270 f.; 3398, 1573 f.; 3399, 1740 f.; 3400, 1322 f.; 3413, 1360 f.; 3414, 2232 f.

15. Ophioglypha scutellata n. sp.

Plate II. Figs. 4-6.

Diameter of disk, 9 mm.; width of arm close to disk, 1.5 mm.: length of arms unknown. Three to four mouth papillæ on each side; the two (three) outer ones are short, square, and close set, the innermost one and that on the apex of jaw pointed. Mouth shield almost hourglass-shaped, with an angle within and outer edge curved, the lateral sides deeply constricted; longer than broad. Side mouth shields long and narrow, a little narrower without than within, where they meet.

Ventral plates broader than long, all widely separated. First ventral plate rhomboidal, smaller than those beyond; second with inner edge curved, outer edge a little concave; the rest have a short peak within and a median cut in the outer edge; they become gradually shorter, almost rectangular, the short sides of the rectangle made by the outer laterals, the inner laterals standing almost at a right angle to the longitudinal axis of the arm, re-enteringly curved. The first two ventral plates are separated by a small rectangular plate, which also separates the side arm-plates of the first joint (this plate is not developed on all the arms, but there is then a rectangular naked space on the same place). Between the second and third ventral plate there is a triangular or rectangular naked space, which separates the side arm-plates of the second joint. Also at the inner end of the fourth ventral plate there may be a little naked space. Under side of the arm (inner part) somewhat hollowed. Side arm-plates meeting below from the third arm-joint, above from the fourth or fifth; their outer edge rather prominent. Dorsal plates all with outer edge rounded and lateral sides a little re-enteringly curved. The first is rudimentary, enclosed in the very small incisure of the disk; second to fourth have inner end truncated, from the fourth they are triangular with an acute angle within. Third and fourth are much longer than broad, and by a transverse line divided in two pieces, of which the inner is rectangular, the outer of the same shape as the second dorsal plate.

Disk covered with rather delicate overlapping scales, among which the primary plates are not very conspicuous. Radial shields not very large, meeting broadly without, separated within by some few scales. Interbrachial space with a rather large, semilunar marginal plate (not distinct

in the figure). Under side of the disk covered with small scales only. The edge of the disk sharp, both sides rounding equally towards it. Genital scales narrow, in two pieces. Papillæ along the genital slits very small, close set, rounded; they become somewhat larger as they pass to the dorsal side of the arm to form the arm-comb; only about five papillæ to be seen from above; they are not pointed. There is no secondary arm-comb.

Four to five short, close set arm-spines, growing gradually longer from above downwards; they are nearer to the ventral than to the dorsal side. First tentacle pore opening into the mouth space; the next pores rapidly diminishing in size, distinct to the 8th–9th joint. Tentacle scales: first pore has 4–5 on each side; second, three on inner, two on outer side; third, two on inner, one on outer side; fourth, one or none on inner, one on outer side; and from the fifth there is only one on the outer side.

Color in alcohol: gray.

One specimen from Station 3425, 680 f.

16. Ophioglypha nana n. sp.

Plate II. Figs. 10-12.

Diameter of disk, 6 mm.; width of arms close to disk, 1 mm.; length of arms unknown. Five short, square, close set mouth papillæ on each side, and one diamond-shaped at the apex of jaw; the two outer ones broader than the others. (It may be incorrect to name the outermost one a mouth papilla; it reaches from the first ventral plate to the inner end of the first tentacle pore. In other species of *Ophioglypha* that piece is evidently not a mouth papilla like the rest of them, but here it seems to be so.) Mouth shield pentagonal, an angle within, outer edge with a little peak in the median line; the corners rounded; equally broad and long. Side mouth shields rather short, narrow, of nearly equal width, meeting within.

First ventral plate with inner edge rounded and an obtuse angle without. Those beyond are triangular, with a little median peak on the outer edge, the lateral sides are a little re-enteringly curved; on the second to fourth that is not distinct on account of the tentacle pores. They are equally long and broad. Side arm-plates a little rounded, meeting broadly below from the first, above from the second or third joint. Dorsal plates triangular, all sides a little curved. The first three are of different shape; the innermost is quite rudimentary, separating the two parts of the arm-comb; its outer

edge is concave; the two next have inner end truncated, outer edge curved; they are not separated by the side arm-plates. There is almost no incisure in the disk at the base of the arms.

Disk covered with rather coarse, overlapping scales, among which the primary plates are not conspicuous. The central plate is five-sided, with a little scale at each corner. Radial shields rather short, not very conspicuous, meeting broadly without, separated within by one or two scales; they do not meet in the median line, but the right radial shield overlaps the left. In the interbrachial space there is a rather large marginal plate, which connects the radial shields of each two adjoining arms. Under side of the disk covered with a few rather large scales. The edge of the disk is sharp. Genital scale rather broad; the papillæ along the genital slits very small and indistinct, rounded; they become somewhat larger as they pass to the dorsal side of the arm to form the arm-comb; only three or four papillæ to be seen from above; there is no secondary arm-comb. The genital slits begin at the first ventral plate, the papillæ only at the end of the mouth shield; along the inner part of the slit there is a long, narrow scale, adjoining the side edge of the mouth shield.

Three short arm-spines, the upper one a little apart from the other two. First tentacle pore not opening into the mouth space; on the second to fourth joint they rapidly diminish in size; beyond the fourth there are no pores at all. Tentacle scales: first pore has 4 on outer, 3–4 on inner side; second, 1–3 on outer, 2–3 on inner side; third, 1–2 on both sides; fourth, 1–2 on outer, none or a very small one on the inner side. On the next joints a little rudimentary tentacle scale sometimes may be found.

Color in alcohol: gray.

One specimen from Station 3364, 902 f.

17. Ophioglypha divisa n. sp.

Plate IV. Figs. 10-12. Plate V. Figs. 1, 2

Diameter of disk, 11 mm.; width of arm close to disk, 2 mm.; length of arms unknown, but presumably about 3–4 times the diameter of the disk. Mouth papillæ 5–6 on each side, short, square, making a close line; the outermost ones a little broader than the others; one diamond-shaped at the apex of jaw, scarcely longer than those at the sides. Mouth shield very curious; divided by a median line, which bifurcates at the outer

end; it thus consists of one small median and two large lateral pieces. (Plate IV. Fig. 10.) Other specimens have the mouth shield divided into two pieces only by a median line. (Plate V. Fig. 1.) Side mouth shields rather short and broad, meeting within. The whole mouth angle is somewhat hollowed.

First ventral plate with inner edge rounded, outer edge forming a very obtuse angle. The other ventral plates triangular, with the sides a little curved; the second to fourth have their lateral sides inconsiderably restricted by the tentacle pores. They are equally long and broad, all widely separated. The side arm-plates have the outer edge a little prominent; they meet above from the fourth or fifth joint. The dorsal plates are divided in two pieces by a longitudinal line, which is rather irregular; sometimes it is almost straight, median; sometimes it is wholly wanting on a few joints, the dorsal plates there being thus undivided. They are triangular, the first three or four, which are in mutual contact, with inner end truncated; outer edge rounded; they are equally long and broad.

The disk is covered with rather coarse, not overlapping scales, among which the primary plates are distinct; round the scales there are some indistinct ridges. The radial shields not very large, somewhat irregular, separated by a single row of scales, sometimes just meeting without. Incisures of the disk at the base of the arms very inconsiderable, enclosing one rudimentary dorsal plate; interbrachial spaces with a distinct marginal plate. The ventral side of the disk almost wholly covered by a large plate outside the mouth shield, sometimes divided by a median line (Plate V. Fig. 1), and by the large genital plates; only a few small scales are seen along the margin. The edge of the disk not sharp, both sides being rounded towards the margin. Papillæ along the genital slits close set, square, rather indistinct; arm-comb little developed, only four papillæ to be seen from above; they are small and rounded. The genital scales sometimes do not reach the dorsal side of the arm, the papillæ then are inserted on the outer edge of the radial shields. No secondary arm-comb.

Four short arm-spines, three close together below, of which the middle one is the longest, and one being apart at the upper side of the arm. Only four tentacle pores, very small, except the first, which does not open into the mouth space. Tentacle scales: first pore three on outer, two on inner side; second and third, two on outer, one on inner side; fourth, two on outer, none on inner side.

Color in alcohol: gray.
Five specimens from Stations 3411, 1189 f.; 3413, 360 f.

This species stands very near to *Ophioglypha inornata* Lym., the only difference of any importance, as far as we are able to see, being that the dorsal plates are here not divided by a longitudinal median line. In every other respect the two species seem to be quite alike. LYMAN does not mention that the mouth shield in *O. inornata* is divided by a longitudinal median line, but the figure shows that line very clearly. *O. inornata* was taken in the Atlantic in 1° 47′ Lat. N., 24° 26′ Long. W. (1850 f.).

On Station 3400 was taken a young Ophiuran (diameter of disk 4 mm.), which we must regard as the young of *O. divisa*, though it differs somewhat from the above described larger specimens. Four of the mouth shields are undivided, but the fifth is divided as on Plate IV. Fig. 10;* but especially the covering of the dorsal side of the disk is different, the six primary plates being very large, polygonal, taking up by far the most space. At the margin of the disk are seen the short, broad, polygonal, not separated radial shields and two smaller plates in each interbrachial space. No genital papillæ or arm-comb yet developed. The dorsal plates as yet only partly divided by a median line, but on some few of them this line is distinct. There are only one or two arm-spines below and one at the upper side of the arm. Mouth papillæ and tentacle scales as on the larger specimens; nor do the ventral plates show any noteworthy difference. (Plate V. Fig. 2.)

The eight species here described included, there are now known no less then eighty-seven species of the genus *Ophioglypha*. Evidently the genus needs to be subdivided; but it seems impossible to do so without having specimens, or at least good figures, of all the species. Meantime very much is still wanting in this respect, several of the species having never been figured. Some species, however, show more or less important characters in common, and such will possibly form definite groups or subgenera. LYMAN established three groups with the types *O. ciliata* Retz., *O. bullata* Wyv. Thoms., and *O. nodosa* Ltk., but for many species he did not find any common character of importance. LUDWIG (72) proposes to make a separate genus of those species which have no arm-comb, *Ophioglyphina*. We do not believe this character to be of so great value, as these species are

* Sometimes also an undivided mouth shield may be found in larger specimens.

evidently not all closely related. Thus, *O. aurantiaca* Verr. and *O. inermis* Lym. are not very nearly related to *O. deshayesi* Lym. and *O. abyssorum* Lym.; again *O. maculata* Ludw. belongs to the group of *O. ciliata* and has no close relation to any of those named above. *O. fraterna* Lym. and *O. saurura* Verr. have no arm-comb either; but as these species are not figured, it is almost impossible to say anything with certainty about their relations.

A character, which may be of importance, is to be derived from the tentacle pores: whether they continue far out on the arms, or are only found on the first four–five joints, as in our *O. nana* and *O. divisa*, and without doubt in several of the species figured by LYMAN. The most important character however seems to be the form of the ventral plates. In LYMAN's first group (type *O. ciliata* Retz.) the ventral plates are short, all widely separated, much wider than long beyond the second plate; in his second and third group the ventral plates of the inner part of the arm are as broad as long, almost hexagonal, in contact in their whole breadth. These two groups are distinguished from each other by the length of the arms: in the second group (type *O. nodosa* Ltk.) only twice the diameter of the disk; in the third (type *O. bullata* Wyv. Thoms.) much longer, about 4–5 times the diameter of the disk. To the latter group belongs our *O. superba*. Some of the species, however, which LYMAN refers to this group, do not appear really to belong to it, e. g. *O. ornata* Lym. and *O. radiata* Lym. These would perhaps better form another group with *O. radiata* Lym. as type, characterized by the axe-shaped ventral plates. To this group would belong our *O. abcisa* and perhaps *O. obtecta*. Another group apparently would be formed of the species with ventral plates, as in our *O. tumulosa* and *O. plana*. Finally, the specimens with all the ventral plates widely separated, which do not belong to the first group, would perhaps form one or two special groups. Evidently a natural subdivision of the genus *Ophioglypha* would not be very difficult to work out, but it will be necessary to have ample material for comparison.

Ophioglypha Forbesi Duncan is said by KOEHLER (128) to form an intermediate type between the genera *Ophioglypha* and *Ophiomusium*. That surely is not correct. The most important character which distinguishes *Ophiomusium* from *Ophioglypha* is found in the first pair of tentacle pores (in reality the second pair). In *Ophioglypha* these pores are very large and conspicuous, in *Ophiomusium* they are not at all seen from without, but lie totally in the mouth space. (This character however was not mentioned by LYMAN.) Only *Ophiomusium flabellum* Lym. and *O. pulchellum* Wyv. Thoms.

make an exception; but they ought not to be referred to the genus *Ophiomusium*, they would better make a separate genus. The other characters of *Ophiomusium*, closely soldered disk-plates, few tentacle pores, etc., may also be found in *Ophioglypha* species. *Ophioglypha Forbesi* evidently is a typical *Ophioglypha* species.

18. Ophiocten pacificum n. sp.

Plate III. Figs. 5–7.

Diameter of disk, 12 mm.; width of arm close to disk, 2.5 mm.; length of arms, 5 to 6 times the diameter of the disk. Four short, close set mouth papillæ on each side of mouth angle; the two outer ones are broad, especially the outermost; the two inner ones and that on the apex more acute, though not spiniform. Mouth shield somewhat broader than long, with outer edge a little curved, outer corners rounded, lateral sides straight; an obtuse angle within. Side mouth shields a little broader within than without, not always meeting within.

Ventral plates all widely separated; the first one four-sided, larger than the following, with outer edge slightly curved, lateral sides almost straight, inner end truncated. The other ventral plates have their outer edge strongly curved and an angle within; this angle or peak becomes afterward less prominent farther out on the arm, and the ventral plates thus have their inner side almost straight, with only a little peak in the median line.* The side arm-plates meet broadly below in the whole length of the arm; the sides are slightly curved. The dorsal plates are four-sided, roof-shaped, broader than long; the outer edge is broader than the inner, both are slightly curved, the outer convex, the inner concave, the lateral sides straight. They cover almost the whole dorsal side of the arm, the side arm-plates thus being very broadly separated above. At the base of the arm the sides are partly naked, and both the dorsal and the side plates are somewhat smaller than farther out.

Disk covered with small, irregular, somewhat swollen scales, among which the primary plates are rather inconspicuous. Radial shields small, triangular, separated by numerous small scales. Ventral side of the disk covered with numerous small, overlapping, not swollen scales; edge of the disk sharp, as common in *Ophiocten*. Genital scale not distinct. Some

* Figure 5 gives the ventral plates a little too short, and their outer edge should be a little more curved.

very delicate spines along the outer part of the genital slits (not seen in the figure). Arm-comb consisting of only a few spines on each side, along the outer edge of the radial shields, not continuous over the arm-basis. There are also some few (4–6) papillæ along outer edge of first dorsal plate.

Three arm-spines, close together, sharp, slender, tapering; the upper one on the first 5–6 free joints somewhat longer than one joint, sometimes as long as two joints, farther out scarcely as long as one joint; the two other spines shorter, the lowest one the shortest. First tentacle pore, as common in this genus, not opening into the mouth space. For the other pores it is to be remarked that they do not touch the ventral plates, but lie wholly in the side plates, near the side of the arm. (This is also the case in *O. sericeum* Forb., though not so evident as here.) Tentacle scales: first pore with one on outer side, two, seldom three, on inner side; the rest all with one conspicuous scale on the outer side, next the lowest arm-spine. On the second to fifth or sixth there is also seen a little scale at the distal end of the pore.

Color in alcohol: gray.

Stations 3363, 978 f.; 3365, 1010 f.; 3371, 770 f.; 3375, 1201 f.; 3376, 1132 f.; 3380, 899 f.; 3392, 1270 f.; 3393, 1020 f.; 3398, 1573 f.; 3400, 1322 f.

Most of the specimens rather badly preserved. There are sometimes five mouth papillæ on each side, and they may be a little more pointed than in the figure, though never spiniform. Besides that there are no variations worth mentioning.

19. Ophiomusium glabrum n. sp

Plate IV. Figs. 7-9.

Diameter of disk, 32 mm.; width of arms close to disk, 6 mm.; length of arms, 5–6 times the diameter of disk. Seven to eight close set square mouth papillæ on each side, and one diamond-shaped at apex of jaw; the two–three outer ones a little longer than the rest. Mouth shield small, triangular, mostly restricted at the outer corners, with an acute angle within and outer edge straight; a little longer than broad. Side mouth shields long, broader without than within, where they meet.

First ventral plate transversely elongated (in other specimens it is not so

broad, more hexagonal). The following plates are about equally broad and long, all with an angle within and outer edge curved. Second to fourth have outer laterals re-enteringly curved on account of the tentacle pores; from the sixth they are triangular, with all the sides a little curved. They continue almost to the end of the arm, sometimes only to about the 30th joint; they are all widely separated by the side arm-plates; in some of the larger specimens, however, the second to fifth may be in contact, the inner end of these plates being then truncated. First and second ventral plates are very seldom in contact. Side arm-plates somewhat rounded, outer edge a little prominent; they meet above from about the sixth (free) joint. The dorsal plates are as long as broad, almost rhomboidal on the inner joints, with an angle within and without; farther out they become more elongated, with an acute angle within and an obtuse angle without. They are distinct almost to the end of the arm. The second dorsal plate has its inner angle truncated; in some specimens that is the case with others of the inner dorsal plates. The first is crescent-shaped, broader than long; inside this there are 3–4 short, broad, irregular, rudimentary dorsal plates.

Disk covered with small, usually angular scales, among which the primary plates are hardly distinguishable. Radial shields very large, widely separated by several irregularly placed scales. One rather large, semilunar marginal plate in the interbrachial space. Ventral side of the disk covered with similar polygonal scales, among which are sometimes seen some small spines or grains. Towards the margin there are some few larger scales. Edge of the disk rather sharp, the dorsal side not rounding towards the ventral side. Genital scale narrow, but usually distinct in the whole length. Genital slits reaching only the third joint, with a double row of close set, square papillæ, one on the genital scale, the other along the side arm-plates. Outside the genital slits the genital scale widens and bends a little away from the arm; for which reason the third and fourth arm-joint appear somewhat wider than the other arm-joints. (Not always so distinct as in Figure 7.)

Seven to eleven short, delicate arm-spines, equally spaced. Only the lowest one is sometimes thicker and longer than the rest. Four pairs of large tentacle pores; some specimens have five pairs; not seldom only one of the pores of the last pair is developed. One rather large tentacle scale on the outer side, and one or two on the inner side.

Color in alcohol: gray.

Numerous specimens from Stations 3362, 1175 f.; 3363, 978 f.; 3366, 1067 f.; 3374, 1823 f.; 3376, 1132 f.; 3381, 1772 f.; 3382, 1793 f.; 3392, 1270 f.; 3399, 1740 f.; 3400, 1322 f.; 3414, 2232 f.; 3431, 995 f.

Younger specimens differ in having the radial shields separated by only a single row of scales; the primary plates are distinct. The genital slits only reach to the second joint, and there are only 4–6 arm-spines.

The larger specimens do not vary to any great extent. The mouth shield sometimes is divided by a transverse line, and also in general outline it is rather variable. The arm-spines sometimes are shorter and thicker. Sometimes there are a few small spines along the margin of the disk. There is a rather thick skin over the disk scales, which are not hidden by it, the skin being translucent.

20. Ophiomusium Diomedeæ n. sp.

Plate IV. Figs. 1-3.

Diameter of disk, 13 mm.; width of arm close to disk, 2.5 mm.; length of arms unknown. 7–8 mouth papillæ to each side: the three outermost ones are rather long, closely soldered together, somewhat rounded; the four–five innermost ones are shorter, more pointed, and not close set; one pointed on apex of jaw. Mouth shield small, spearhead-shaped, with outer edge straight; a little longer than broad. Side mouth shields with outer end broad, inner end somewhat narrower; meeting within.

First ventral plate very small, polygonal. All ventral plates with outer edge straight; the three–four first are in mutual contact, the second and third having their inner end truncated; second to fourth have the lateral edges rather deeply constricted by the tentacle pores; from the fifth they are triangular, widely separated; they continue to the end of the arm (as far as can be judged, all the arms being broken). Side arm-plates with outer edge rather prominent, thick, rounded; meeting below from the fourth, above from the second joint. Dorsal plates triangular, their outer edge almost straight, only with a little peak in the median line; the first dorsal plate has inner end truncated. At the arm-basis there are some rudimentary, irregular polygonal dorsal plates, and at the sides (outside the radial shields) there are, corresponding to these dorsal plates, some plates, which look like rudimentary side arm-plates, but are not so really. Arms flat above and below.

Disk covered with distinct, rather thick, smooth, polygonal scales, among which the primary plates are not to be seen, except the pentagonal central plate. Radial shields not quite so long as half the radius of the disk, twice as long as broad. They are widely separated by a single row of scales. In the interbrachial spaces there is a conspicuous marginal plate, separated from the radial shields only by some very narrow scales. Under side of the disk covered by similar polygonal plates. The edge of the disk not sharp, both sides rounding towards each other. Genital scales distinct, but not very wide; genital slit reaching to the margin of the disk; its inner end, at the outer end of the mouth shield, is somewhat widened; here is seen a little triangular opening. Papillæ along the genital slits distinct, close set, rounded. They do not extend to the dorsal side of the arm, there being no arm-comb.

Five (four–six) short, equal arm-spines, the two or three lowest a little closer together than the others. Only the first three joints with tentacle pores, each pore with one large oval tentacle scale at the outer side.

Color in alcohol: gray.

1 specimen from Station 3404, 385 f.

From the same station there is another specimen (diameter of disk 5 mm.), which differs from that described, the disk scales being somewhat granulated, and the radial shields not being quite separated. There are four arm-spines; the ventral plates are separated from the third. Evidently it is a younger stage of the same species.

21. Ophiomusium variabile n. sp.

Plate IV. Figs. 4–6.

Diameter of disk, 14 mm.; width of arms close to disk, 2.5 mm.; length of arms, c. 5 times the diameter of the disk. Seven close set square mouth papillæ on each side, one longer, pointed at apex of jaw; the three outer ones are much broader and larger than the inner ones. Mouth shield a little longer than broad, of a curious form; an acute angle within, then widening, with the sides rounded; the outer part very restricted; the whole looks like a leaf with its stalk. Side mouth shields long, their inner end very narrow, restricted by the mouth shield, just meeting within or separated; their outer end is very broad.

First ventral plate very small, triangular, somewhat elongated. The three next with the lateral sides a little restricted by the tentacle pores. The outer edge of the second (and sometimes of the third also) a little re-enteringly curved; the other ventral plates have the outer edge gently curved. From the fifth they are triangular; they continue far out on the arm, but are not distinct quite to the end. They are all about equally long and broad, widely separated by the side arm-plates, which also meet broadly above from the second (free) joint. Outer edge of the side arm-plates not prominent, the sides straight. The dorsal plates have an acute angle within and outer edge very strongly produced, rounded; a little longer than broad. They continue to the end of the arm. At the base of the arm there are four rudimentary dorsal plates, the inner one triangular, with angle inwards (between outer ends of the radial shields), the two next four-sided, much broader than long, the fourth five-sided, with an angle without. At the base of the arms, on each side of the rudimentary dorsal plates there is a more or less developed granular covering, sometimes only some few grains. The arms are very thin and flexible in their outer part.

Disk covered with numerous rather delicate, small, smooth, angular (or rounded) plates, among which the primary plates are usually not to be seen. The radial shields are large and conspicuous, their outer ends more or less broadly in contact, their inner ends separated by some few elongated scales. Their form is rather curious, the outer edge being bent strongly inwards and very long; the margin of the disk therefore bends inwards between the arms. In the interbrachial spaces there is a rather large semilunar marginal plate, separated from the radial shields by a little crescent-shaped plate on each side. Under side of the disk also covered by small, polygonal plates, somewhat larger than those on the dorsal side. The genital scales not distinct; the genital papillæ quite rudimentary; there are some a little more distinct papillæ at the adradial side of the genital slit along the side arm-plates. The genital slit reaches the margin of the disk. The edge of the disk is rather sharp.

Two or three short arm-spines, close together at the under side of the arm; the inner five or six free joints mostly bear only two spines; beyond them there are three.

Three pairs of small round tentacle pores, each with one rounded tentacle scale at the outer side.

Color in alcohol: dark gray.

Six specimens from Station 3417, 493 f. One specimen from Station 3426, 146 f., differs from the other specimens, its disk covering being thicker than common in this species.

The form of the mouth shields is very variable, the inner part being very different in breadth; sometimes it is not broader than the outer part, sometimes there is a little peak within, sometimes it is broadly rounded; on the same specimen scarcely two are alike. The radial shields not seldom are wholly separated.

These two species very much resemble *O. familiare* Koehler, and *O. elegans* Koehler, from the Indian Ocean (67); *O. Diomedeæ* the former, *O. variabile* the latter. They are, however, sufficiently characterized, *O. Diomedeæ* by its inner ventral plates being in mutual contact, *O. variabile* by its curious radial shields.

22. Ophiomusium Lymani Wyv. Thomson.

Plate III. Figs. 8-11.

Wyv. Thomson: Depths of the Sea, p. 172, Figs. 32, 33.
Th. Lyman, Challenger, Vol. V., Ophiuroidea, p. 90.
" " (76), p. 245, Plate V. Figs. 55–57.

As there is not yet given either a full description or detailed figures of this species, it is given here.

Diameter of disk, 30 mm.; width of arm close to disk, 5 mm.; length of arms, 4–5 times the diameter of the disk. Six to seven short, square mouth papillæ on each side, making a close line, and one diamond-shaped (often irregular) at apex of jaw. The outer papilla is somewhat broader than the rest. Mouth shield often irregular, divided in smaller pieces (Fig. 8); its appropriate form, however, is that seen in Figure 9: an acute angle within, outer edge straight, lateral sides deeply restricted, the inner part of the shield being much narrower than the outer; it is somewhat longer than broad. Side mouth shields large, meeting within, the outer end much broader than the inner end.

First ventral plate of a peculiar form: inner edge concave, the corners produced along the sides of the mouth slit; lateral sides straight and outer edge slightly concave, with a little peak in the median line. The two next ventral plates small, pentagonal, with an angle within and outer edge as on the first plate; lateral sides with a restriction on the middle part for the

tentacle pores. They are just in contact. No ventral plates beyond the third. Side arm-plates from the third joint closely soldered together in their whole length; on the dorsal side they are broadly in contact from the first joint. Their sides almost straight; the outer edge makes a fine curve (convex inwards) across the under side of the arm; on the sides of the arm it is rather prominent. Dorsal plates very small, triangular, with outer edge strongly rounded. They continue almost to the end of the arm. At the arm basis, outside and between the outer ends of the radial shields, there are some small, irregular plates, whereof the median row must be regarded as rudimentary dorsal plates.

Disk covered with small but distinct, irregular, polygonal scales, among which the primary plates are not distinct except the central plate. Radial shields very large, more than half the radius of the disk, separated by a single row of scales, two of which are rather large; between their inner ends are some more irregularly placed scales. Each interbrachial space is occupied by a double row of scales and by a large marginal plate, which connects the radial shields of each two adjoining arms. Under side of the disk covered by several small and large, irregular polygonal flat scales, among which one outside the mouth shield is most conspicuous; usually it joins the outer edge of the mouth shield. Genital scale rather large, ending at the third arm joint. Genital slits very narrow, reaching only to the second, in some specimens to the third joint; the inner end is curved. No genital papillæ. Under side of disk and arms quite flat; the dorsal side is rounded towards the ventral side; the edge of the disk, which is not sharp, is thus at the level of the ventral side.

Six to eight small, rudimentary arm-spines; the second from below is a little larger and almost covers the first. On the outer part of the arm the spines have the form of hooklets. Only two pairs of tentacle pores, the first with one or two oval tentacle scales at the outer side, the second with one.

The whole dorsal side of the disk and the side arm-plates above and on the sides of the arm beset with a close granulation, which is most developed on the radial shields, the marginal plate, and the side arm-plates. The granulæ on the other scales of the disk are much smaller and inconspicuous. The edges of the radial shields are smooth; the side arm-plates have the granulæ only along the upper and outer edge. The whole underside is perfectly smooth; only on the large plate outside the mouth shield there may be a single tubercle.

Color in alcohol: gray.

Other full grown specimens differ very little from that described. The granulation is not always so richly developed, especially the side arm-plates may be perfectly smooth. The shape of the mouth shield and the adjoining plate is rather variable. Sometimes there is only a single row of scales in the interbrachial spaces on the dorsal side.

In very young specimens (diameter of disk 4–5 mm.) the granulation is not yet developed; the first ventral plate is pentagonal with an angle inwards, and all the ventral plates are widely separated; only 3–4 arm-spines. The mouth shield is pentagonal, not longer than broad; the large plate outside the mouth shield occupies, together with the large genital scales, almost the whole under side of the disk, only a pair of small plates being seen at the margin. On the dorsal side of the disk the six primary plates are very conspicuous, thick and high, as large as the radial shields, which are in mutual contact only at the outer end, separated within by a small scale; among the primary plates are also seen some small scales. The interbrachial space is covered by a large marginal plate and a smaller one inside that. Only one of the rudimentary dorsal plates yet developed. (LYMAN, 76, Figs. 55–57.)

Numerous specimens from Stations 3362, 1175 t.; 3363, 978 f.; 3364, 902 f.; 3371, 770 f.; 3376, 1132 f.; 3392, 1270 f.; 3393, 1020 f.; 3407, 885 f.; 3411, 1189 f.; 3431, 995 f., 3432, 1421 f.

LYMAN (Challenger) records this species from the Pacific (88° 2′ W., 38° 6′ S.), but he has only seen an arm of it. Evidently it is very common in this ocean, as well as in the Atlantic.

The 24 species of *Ophiomusium* now known are easily subdivided into two groups: those which have ventral plates in most of the length of the arm, and those which have ventral plates only on the 3–5 first joints. The former group, again, seems to need to be divided into those in which the genital slits do not reach the margin of the disk, and those with very large genital slits, reaching the margin of the disk. To the latter group belong *O. familiare* Koehler, *O. elegans* Koehler, our *O. Diomedeæ* and *O. variabile*, and (perhaps) *O. laqueatum* Lym. The two species *O. flabellum* Lym. and *O. pulchellum* Wyv. Thoms. ought not to be reckoned as *Ophiomusium*, as they differ from all the other species in having pores at the sides of the first ventral plate. As said above under *Ophioglypha*, it must be maintained as one of the most important characters of the genus *Ophiomusium* that there are no tentacle pores visible to the first ventral plate.

23. Ophiactis Savignyi (M. & Tr.).

LYMAN: Challenger, Vol. V., Ophiuroidea, p. 115.

One specimen from Acapulco.

24. Ophiactis profundi n. sp.

Plate VI. Figs. 4-6.

Diameter of disk, 6 mm.; width of arm close to disk, 1 mm.; length of arms, c. 5 times the diameter of the disk. One very large, axe-shaped mouth papilla on each side; the one at the apex below the teeth triangular, with a more or less distinct peak within. The lower teeth more or less serrate, the upper ones rounded. Mouth shield about as broad as long, almost rhomboidal, an angle within and without; the sides more or less re-enteringly curved, the outer sides most so; all the angles rounded. It is somewhat hollowed in the middle. Side mouth shields with outer end much wider than inner end, where they meet.

First ventral plate very small, its outer end much narrower than the inner end; laterals and inner edge slightly concave. The following ventral plates a little wider than long, in mutual contact almost to the end of the arm, where they become more elongated. Sometimes, however, they are separated by a little naked space on the inner joints. They are polygonal, inner end truncated (or with an angle), outer side limited by three rather straight lines, which make two obtuse angles; the middle part of the outer side is usually a little concave; sometimes the whole outer edge is curved; inner and outer laterals re-enteringly curved; they are a little hollowed in the middle. Side arm-plates with spine ridge rather prominent, meeting above from about the 5th joint. Dorsal plates very broad, twice as broad as long, usually all separated; however, the side arm-plates do not meet on the inner joints, there being a little naked space which separates them. The dorsal plates have outer edge rounded, a very obtuse angle within, and lateral sides slightly rounded. Arms rather flat, not wider outside the disk. There are constantly six arms.

Disk covered by small, smooth, rather thick, overlapping scales, among which the primary plates are not distinct. No spines on the disk. The radial shields about as long as half the radius of the disk, narrow, with

adradial edge straight, abradial edge curved, and outer edge straight; they are separated by a single row of scales; mostly there are no scales along their outer edge. Under side of the disk covered with scales similar to those on the dorsal side. Edge of the disk rather sharp.

Three rather stout, smooth arm-spines, the middle one the stoutest; they are as long as one joint and a half. One large oval tentacle scale.

Color in alcohol: pale brown.

Stations 3380, 899 f., 6 specimens; 3406, 551 f., 1 specimen.

Inside the large mouth papilla there is sometimes seen another papilla, and it thus looks as if there were two mouth papillæ on each side; however, it is not so: this papilla belongs to the first mouth tentacle, and is thus the same as that usually seen in *Amphiura*. Some of the specimens have one half of the disk regenerated and the three arms more or less shorter than the rest. This species thus has self-division.

Evidently this species is closely related to *Ophiactis flexuosa* Lym., from which it is separated only by small differences: the form of the mouth shield, of the large mouth papilla (?), of the ventral plates, and of the radial shields; further, *O. flexuosa* has distinct scales all round the radial shields, whereas *O. profundi* has no scales outside of them. Finally, *O. flexuosa* has five arms, whereas *O. profundi* has six. The latter character evidently is the most important. On page 116 of the Challenger Report, LYMAN says: "The ten specimens from Station 142, 150 fathoms, may be the young of this species (*O. flexuosa*). They have six arms, while *Ophiactis flexuosa* has but five." That *O. profundi* is not the young of *O. flexuosa* is evident. The largest specimens have a diameter of 6 mm., the specimen of *O. flexuosa* described by LYMAN only 7 mm. Upon the whole, we think there is no sufficient evidence that in any species the young has six arms, the adult only five. We therefore also doubt that LYMAN is right in asserting that to be so in *O. Mülleri* Ltk. We have found nothing in the literature which definitely shows that to be the case. LÜTKEN (Additamenta, Vol. II. p. 230) describes an older 5-armed specimen, and then only says: "Though I presume this form to be a separate species, I will not omit pointing out the possibility that *O. Mülleri* was only the young of this form." LJUNGMAN* says, by the description of the var. *quinqueradia*, that he has not been able to tell definitely whether it was a new species or the adult of *O. Mülleri*. LYMAN himself says (Ill. Catal. Mus. Comp. Zoöl., Vol. I.

* Öfvers. kgl. Svenska Vetensk. Akad. Förhandl., 1871.

p. 110): "As a rule the number [of arms] is six, and of these two or three are almost always smaller than the rest. The arms vary much in number; occasionally a specimen may be seen with only *one*. A young one had five arms about 3.5 mm. long, the diameter of disk being 1.2 mm." Beyond that he gives no further evidence as to the point in question, only in the Challenger Report he definitely says it to be so (p. 113). On page 116 he says, "The so called adult of *O. Mülleri* has five arms." It thus seems that LYMAN was, however, not wholly convinced that it was so.

Also to *O. plana* Lym. this species will be closely related; but as no figures are given of that species, it is almost impossible to say anything definitely about it. From the notice in the Challenger Report, page 116, it seems that *O. plana* has six arms; in the original description nothing is said of this.

25. Ophiactis duplicata (Lym.).

Plate VI. Figs. 1-3.

Amphiura duplicata LYMAN. Ill. Catal. Mus. Comp. Zoöl., No. VIII., Part II. p. 19. Plate V. Fig. 78; outline, Fig. 87.
" " " Challenger Ophiuroidea, p. 136. Plate XVII. Figs. 10–12. (76), p. 251.
" " KOEHLER. (64), p. 74; (127), p. 49.

To this species we refer with a little doubt some specimens from Stations 3380, 899 f. (together with *O. profundi*), and 3407, 885 f. As this species has hitherto been known only from the Atlantic, it is important to be quite sure of the identification; but the figures hitherto given thereof are not quite satisfactory, so we are not wholly convinced of the identity. We therefore give figures of our specimens.

The differences found between the Atlantic and the Pacific specimens are rather unimportant. The mouth papillæ, mouth and side mouth shields, and the ventral plates, show some small differences, as will be seen by comparing LYMAN's figures with ours. But, as there is some variation in our specimens in respect to mouth papillæ (3–5), mouth shield (sometimes restricted at the outer end, not rounded), and first ventral plate (more rounded), there cannot be much stress laid upon that. It is to be remarked that the outer edge of the ventral plates is a little re-enteringly curved from outside the disk; whether that is a real difference or not cannot be seen from LYMAN's figures and description. Outside the radial shields there is a little very narrow scale. Finally, the (five) arms appear to be a little shorter

than in LYMAN'S specimens, only three times the diameter of the disk. LYMAN gives the length of the arms as five times the diameter of the disk.

LYMAN has referred this species to *Amphiura*, but in this he is evidently wrong. It must be emphasized that one of the most essential features of *Amphiura* is that there are *two* large mouth papillæ at the apex of jaw, below the teeth. Ophiurans which have not that character cannot be named *Amphiura*. (At the same time it cannot be said that all Ophiurans with that character belong to the genus *Amphiura*.) Especially the genus *Ophiactis* can only be distinctly separated from *Amphiura* through that feature. *Ophiactis* has never two mouth papillæ at the apex,* but only one small one (which may also be considered as the lowest tooth). Some more of LYMAN'S species of *Amphiura* thus evidently are also to be transferred to *Ophiactis*, — *A. canescens* Lym. and *A. patula* Lym. Further, one of the species described by KOEHLER (67), *Amphiura partita*, evidently should also be transferred to *Ophiactis*, being closely related to *O. duplicata*, as it has the same remarkable feature of the divided first ventral plate. Curiously enough another of the species described by KOEHLER (67), and referred to *Ophiactis*, namely, *O. Lorioli*, evidently is an *Amphiura*.

26. **Amphiura serpentina** n. sp.

Plate VIII. Figs. 1-8. Plate IX. Figs. 1-2.

Diameter of disk, 9 mm.; width of arm close to disk, without spines, 1.5 mm.; length of arms, 7–8 times the diameter of the disk. Two mouth papillæ on each side of the mouth angle, the outer one large, irregular, often with two lobes, sometimes wholly divided in two. Mouth shield a little longer than wide, with inner edge strongly rounded; its outer part is restricted, stalk-like, outer edge rounded. Side mouth shields separated or scarcely meeting within, much wider without than within.

First ventral plate small, six-sided. Those beyond all in mutual contact, with inner end truncated, outer edge straight or slightly concave; outer corners much rounded; outer laterals almost straight, the inner re-enteringly curved. They are equally broad and long; at the inner end they have a feeble keel. Side arm-plates with a well marked spine ridge; on the inner part of the arm there is a naked space outside each tentacle pore,

* In *O. duplicata*, however, there are sometimes two mouth papillæ at the apex, but never on more than one or two of the jaws.

the side plates thus not reaching the foregoing joint; that naked space is distinct also from the dorsal side. The side plates just meet above on the inner joints, then are separated by the dorsal plates, and finally they again meet in the outer part of the arm. Dorsal plates transversely oval, with all sides rounded, scarcely separated on the inner joints, then in contact almost to the end of the arm, where they again become separated; about twice as broad as long.

Disk covered by small but distinct overlapping scales, among which no primary plates are seen. The radial shields rather large, almost semilunar, pointed within, rounded without, twice as long as broad, their length being equal to half the radius of the disk. They are separated by some few, irregularly arranged, small scales; sometimes they meet at their outer end. Outside the radial shields is a narrow belt of scales in continuation of those in the interbrachial space. Over the arm-basis there is a rather deep but narrow incisure in the disk. Under side of the disk covered with smaller yet distinct scales. Genital scale distinct only at the inner end of the genital slit. The margin of the disk re-enteringly curved; the edge of the disk not sharp.

Three, on the inner joints four, equal tapering arm-spines, a little longer than an arm-joint. Two small tentacle scales, which do not form a right angle with each other.

Color in alcohol: gray, with a bluish tint.

This species is very variable. Considering the described specimen as the typical form, there can be distinguished no less than three rather constant varieties:—

Var. *a* (Plate VIII. Figs. 4, 5) differs from the typical form in the following respects. The mouth shield has the outer end more restricted, its whole form being somewhat different (in other specimens, however, it has the same shape as in the typical form). The ventral plates have the outer edge strongly rounded, and there is a more distinct keel; they are a little longer than wide. The radial shields are narrower and separated by many small scales, which are disposed in rather regular series. The scales on both sides of the disk (except those around the radial shields) are very small, but high, looking almost like small grains. The tentacle scales are smaller than in the typical form; sometimes there are three. A specimen from Station 3424 has the mouth shields yet wider than in the typical form; the scales do not resemble grains, are smooth, but as small as in the figured specimen.

Var. *b* (Plate VIII. Figs. 6–8) resembles the typical form very closely. The ventral plates have the outer edge more rounded, and there is a more distinct keel; the radial shields are narrower. The most important difference is, however, that it has four, on the inner joints five, arm-spines; the upper one is the shortest, about as long as half an arm-joint; they then become gradually longer downwards, the lowest being the longest, a little longer than a joint. The mouth papillæ are more or less pointed.

Var. *c* (Plate IX. Figs. 1, 2) differs much more from the typical species, and should perhaps be regarded as a separate species. The arms are c. 15 times as long as the diameter of the disk (6 mm.). The outer mouth papilla is long and pointed; the mouth shield has not the common form, but there is a rounded angle within, and the outer part is not so much restricted. The ventral plates are more elongated, longer than broad; outer edge usually a little re-enteringly curved. The keel rather indistinct. The dorsal plates are more round than common; the radial shields very narrow, separated by some few scales. The scales of the disk resemble those of *var. a*, but are longer and narrower; the primary plates distinct. In other respects it resembles the typical form. (One specimen only.)

In the typical form and *var. b* the spines may have a dark brown tint on the middle, and the mouth then has the same color.

Several specimens from Stations 3384, 458 f. (typical form); 3393, 1020 f. (*var. b*); 3394, 511 f. (*var. a*); 3402, 421 f. (*var. c*); 3419, 772 f. (*var. a*); 3424, 676 f (*var. a*).

27. Amphiura gymnogastra n. sp.

Plate IX. Figs. 6-8.

Diameter of disk, 9 mm.; width of arm close to disk, without spines, 1 mm.; length of arms, about ten times the diameter of the disk. One rather long and stout conical mouth papilla on each side,* besides that on the apex. Mouth shield equally long and broad, almost rhomboidal, outer sides a little re-enteringly curved, inner sides straight, all the angles rounded, the inner angle more so than in the figure. Side mouth shields sometimes meeting within, sometimes separated, much broader without than within; they may also be quite triangular.

* One specimen has two outer papillæ on one mouth angle.

First ventral plate very small, six-sided; those beyond equally wide and long, rather broadly in contact; they have inner angle truncated, outer edge concave, outer corners rounded, outer laterals almost straight, inner ones re-enteringly curved. Side arm-plates with spine-ridge very little prominent; as usual there is a naked space separating the side plates of each two adjoining joints, that space being distinct also from the dorsal side. Dorsal plates in mutual contact, somewhat more broad than long, with a rounded peak within and without, the latter however very indistinct; inner sides a little re-enteringly curved, side corners rounded.

Dorsal side of the disk covered with small, overlapping scales, among which the primary plates are not conspicuous. Radial shields about half as long as the radius of the disk, separated within by more small scales, without by one elongated scale, just meeting at their outer ends. Their adradial edge is straight, the abradial curved; inner end pointed, outer end broadly rounded. Outside the radial shields there are more small scales, and there is a rather deep, narrow incisure in the median line. The under side of the disk is quite naked, only the inner end of the genital scales being distinct.

Five, farther out four, rather short, tapering arm-spines, increasing in length downwards, the lowest being as long as a joint. Two small tentacle scales, not standing at a right angle.

Color in alcohol: gray.

Five rather badly preserved specimens from Station 3392, 1270 f.

This species is very closely related to *A. semiermis* Lym., and should perhaps not be considered as a separate species. It differs from that species in the form of the mouth shields and the ventral plates; the outer edge is more concave and the outer corners more prominent than in *A. semiermis*.* It is closely related also to *A. lanceolata* Lym., but in like manner separated from that species by the form of the mouth shield, and the ventral and dorsal plates.

28. Amphiura polyacantha n. sp.

Plate IX. Figs. 3-5.

Diameter of disk, 8 mm.; width of arm close to disk, without spines, 1.4 mm.; length of arms 10–11 times the diameter of the disk. One rather long, conical mouth papilla on each side, besides the infradental one. Mouth shield a little longer than wide, inner part strongly rounded, outer

* We have had specimens of *A. semiermis* determined by Lyman himself, for comparison.

part slightly restricted. Side mouth shields very short and wide, triangular, not meeting within.

First ventral plate short, polygonal; those beyond about as long as wide, the two–three inner ones, however, a little longer than the rest. They have all the inner angle truncated, outer edge concave, outer corners rounded, outer laterals almost straight, inner ones a little re-enteringly curved. Side arm-plates with spine-ridge little prominent. As usual in *Amphiura*, the side arm-plates of each two adjoining joints are separated by a naked space, which is very distinctly seen also from the dorsal side. The dorsal plates are almost egg-shaped in the inner part of the arm, farther out they become more transversely oval, and towards the end of the arm they again become egg-shaped; they are in mutual contact almost to the end of the arm. The inner ones are a little longer than wide, farther out they are somewhat wider than long, and towards the end of the arm they are almost equally wide and long.

The disk is partly naked; round the radial shields there is a broad band of small, but distinct, rounded, overlapping scales; in the central part of the disk there are only some few irregular, spread scales, between which the naked skin is seen; and along the margin there is a completely naked band. The primary plates not distinct. The radial shields are narrow, elongated, with outer ends just meeting, inner ends separated by more small scales. Outside the radial shields there is a little naked space, separated from the naked band along the margin of the interbrachial spaces by a few scales, in continuation of those around the radial shields. A rather deep but very narrow incisure in the median line between the outer end of the radial shields. Under side of the disk wholly naked.

Six, on the inner joints seven to eight arm-spines, the upper one about half the length of an arm-joint, then they gradually increase in length downwards, the lowest being a little longer than a joint. They sometimes are a little widened at the end. Two small tentacle scales, making a right angle with each other, though not in the typical manner, as in *A. Chiajei* Forbes.

Color in alcohol: dark gray.

One specimen from Station 3353, 695 f.

29. Amphiura seminuda n. sp.

Plate XI. Figs. 1-3.

Diameter of disk 6 mm.; width of arms close to disk, without spines, 1 mm.; length of arms unknown. One short, conical mouth papilla on each side; the infradental papillæ with inner end truncated and the abradial corner a little produced. Mouth shield equally wide and long, with an obtuse rounded angle within, inner sides curved, outer sides concave; side corners and outer edge rounded. Side mouth shields meeting within, broader without than within.

First ventral plate small, elongated-hexagonal. Those beyond with inner end truncated, outer edge concave, outer corners rounded, outer laterals almost straight, inner re-enteringly curved. They are inconsiderably longer than wide. Side arm-plates with spine-ridge not very prominent; the naked space which separates those of each two adjoining joints is not seen from the dorsal side. Dorsal plates transversely oval, with an indistinct angle within, about twice as broad as long. They are just in contact in the inner part of the arm.

The dorsal side of the disk is covered by delicate, rounded, overlapping scales, among which the primary plates are not distinct. The radial shields almost semilunar, as long as half the radius of the disk; they are in contact in their outer half, their inner ends separated by a single row of scales. Outside the radial shields is seen only one very narrow scale. The incisure between the outer ends of the shields very small. Edge of the disk rounded, the margin almost straight. Under side of the disk naked, except that there is along the margin a band of scales, similar to those of the dorsal side. Genital scales distinct at the inner end.

Three equally long, tapering, rather stout arm-spines, a little longer than an arm-joint. One small, rounded tentacle scale at the inner corner of the pores.

Color in alcohol: pale brownish.

One specimen from Station 3430, 852 f.

30. Amphiura brevipes n. sp.

Plate XI. Figs. 4-6.

Diameter of disk, 8 mm.; width of arms close to disk, 1.3 mm.; length of arms not known with certainty, but evidently they are only about 4 to 5 times the diameter of the disk. One conical, rather short mouth papilla on each side; the infradental papillæ have the abradial corner produced. Mouth shield equally wide and long, almost rhomboidal, with a right angle within, side corners rounded and outer angle truncated; inner sides straight, outer sides slightly concave. Side mouth shields short, very wide, meeting broadly within; their outer end is considerably broader than the inner end.

First ventral plate rather large, more than half the length of the second; those beyond the first equally long and wide, rather broadly in contact in the inner part of the arm; farther out it is only the tip of the inner angle which reaches the foregoing plate. Outer edge curved, outer corners much rounded; inner and outer laterals slightly re-enteringly curved. Side arm-plates with rather prominent spine-ridge; the naked space separating the side plates of each two adjoining joints also seen from the dorsal side. Dorsal plates about twice as broad as long, just separated by the side arm-plates; they are transversely oval, their inner sides a little sigmoidly curved.

Dorsal side of the disk covered with delicate, overlapping scales, among which the primary plates are not distinct, except the central plate. Radial shields scarcely half as long as the radius of the disk, separated in their whole length by one or two narrow, elongated scales. They are almost semilunar, the outer end truncated. Along their outer edge is a single row of small scales; almost no incisure in the disk. The under side of the disk is partly naked, though with some few spread scales; only along the margin there is a rather broad band of scales, like those on the dorsal side. Inner end of the genital scale just visible. Edge of the disk rounded, the margin a little re-enteringly curved.

Three equal tapering arm-spines, as long as a joint. No tentacle scales.

Color in alcohol: gray.

One specimen from Station 3399, 1740 f.

31. Amphiura gymnopora n. sp.

Plate XI. Figs. 7–9.

Diameter of disk, 6 mm.; width of arm close to disk, without spines, 1 mm.; length of arms about ten times the diameter of the disk. One very short, rounded mouth papilla on each side; the infradental ones simply conical. Mouth shield a little longer than wide, with a rounded angle within, outer part restricted, side corners rounded, inner sides feebly curved. Side mouth shields mostly not meeting within; inner end very narrow, outer end much wider.

First ventral plate small, six-sided; those beyond equally long and broad, just in contact, all with an angle within, and outer edge doubly curved, with a cut in the median line. Outer corners sharp, inner and outer laterals re-enteringly curved; there is a distinct keel along the median line. Side arm-plates with spine-ridge little prominent; the naked space separating the side plates of each two adjoining joints distinct also from the dorsal side. Dorsal plates transversely oval, in mutual contact, twice as broad as long.

Dorsal side of the disk covered with small but distinct overlapping scales, among which the primary plates are not distinguishable, except the central plate. Radial shields scarcely half as long as the radius of the disk; they are separated at their inner end by several small scales, at their outer end only by one elongated scale. Their adradial edge is straight, the abradial curved, especially towards the outer end, which is rather broad, almost straightly cut; the inner end is somewhat rounded. The under side of the disk covered by extremely small but distinct scales. The genital scales distinct in the whole length. Edge of the disk rounded, the margin re-enteringly curved.

Three tapering arm-spines, the median one inconsiderably longer than the others, a little longer than an arm-joint. No tentacle scales.

Color in alcohol: dark gray.

Several specimens from Station 3355, 182 f.

32. Amphiura Diomedeæ n. sp.

Plate XII. Figs. 1-7.

Diameter of disk 14 mm.; width of arm close to disk, 2 mm.; length of arms, 7–8 times the diameter of the disk. Two mouth papillæ on each side, widely separated from those on the apex; they are usually equally large, but sometimes the outer, sometimes the inner one is a little larger; the outer is rounded, the inner more or less conical. Mouth shield with the outer end somewhat restricted, an acute angle within, inner sides a little re-enteringly curved or almost straight, side corners rounded, outer edge straight. In the specimen figured they were wider than long; in some specimens they are equally wide and long; in these latter the inner sides are straight. Side mouth shields rather narrow, their outer end a little broader than the inner end; they just meet within.

First ventral plate small, rounded, or five-sided. Those beyond a little more broad than long (in Figure 1 they are wrongly represented as being equally long and broad). The second and third have the inner end truncated, those beyond have an angle within; on the inner three–four joints they are in mutual contact, then distinctly though not widely separated. The outer edge is concave, outer corners slightly rounded; outer laterals almost straight, inner a little re-enteringly curved. Side arm-plates with spine-ridge little prominent; the naked space separating the side plates is rather small, not seen from the dorsal side. Dorsal plates more than twice as broad as long, with a very obtuse angle within, and outer edge slightly curved, rounding very abruptly at the sides; inner sides re-enteringly curved. They are in contact until far out on the arm, but only the first ones have the inner angle truncated. At the base of the arm are seen one or more small, rudimentary dorsal plates. The arm is rather flat and broad, with a feeble keel above.

The disk is covered with small, overlapping scales, among which the primary plates are distinct. The scales of the under side are smaller; usually they continue over the edge to the dorsal side, where they are very conspicuous, being directed opposite to those of the dorsal side. Usually there are a few more conspicuous scales joining the mouth shield. The radial shields are about as long as half the radius of the disk, wholly separated at the inner end by more small scales, at the outer end by a single row of larger

scales; their adradial side is almost straight, the abradial curved; inner end shortly pointed, outer end so truncated that there results a rather deep curve above the arm. Outside the radial shields there is a single row of small scales or a single narrow scale. Usually the inner end of the genital scale is distinct. The margin of the disk is re-enteringly curved, the edge rounded.

Three tapering arm-spines, the middle the longest, a little longer than an arm-joint. Two tentacle scales, wide, rounded, forming a right angle with each other.

Color in alcohol: disk bluish, often with a reddish tint at the outer end of the radial shields; arms white or pale brown.

Several large specimens from Stations 3393, 1020 f.; 3394, 511 f.; 3398, 1573 f.; and 3429, 919 f.

A large, fine species, which is not very variable. The mouth shields, as above said, are the most variable in form; outer edge of the ventral plates sometimes straight or a little convex. The dorsal plates may be separated also on the inner joints. There are seldom three outer mouth papillæ, and never on all the mouth angles of the same specimen. One specimen (3398) has a small papilla between the two outer mouth papillæ (Fig. 4); also the mouth and side mouth shields are here of another form than the common one. However, there can be no doubt that it is the same species.

From Station 3392, 1270 f., there are three specimens, from Station 3429 one, which differ somewhat from the other specimens of *A. Diomedeæ* (Figs. 5–7). They are all smaller than the specimens from the other stations, and it may be they are only younger specimens of *A. Diomedeæ;* or it may be they are to be considered as a variety of that species; they can scarcely be regarded as a separate species. Differences from the typical form are seen in the shape of the mouth and the side mouth shields; but on that feature no stress can be laid, as it is also rather variable in the typical form; nor is it wholly alike in these four specimens. The first ventral plate has a distinct angle within, and is rather large. In the specimen from Station 3429 the dorsal plates are transversely oval, not of the typical form. The margin of the disk is convex.

33. Amphiura assimilis n. sp.

Plate X. Figs. 5–7.

Diameter of disk, 13 mm.; width of arm close to disk, 2 mm.; length of arms, c. 5–6 times the diameter of the disk. Two (in one specimen three) small rounded, almost equally large mouth papillæ on each side, besides those on the apex. The papilla of the first mouth tentacle is very distinct, almost at the same level as the true mouth papillæ. Mouth shield equally wide and long, with the outer part restricted; an obtuse angle within, sides somewhat irregularly sigmoidly curved, corners rounded, outer edge straight. Side mouth shields a little broader without than within, where they meet.

First ventral plate small, six-sided or rounded; those beyond considerably broader than long. They are rather broadly in contact, their inner end thus being truncated; farther out they are more or less distinctly separated from each other, and have then an angle within. The outer edge, inner and outer laterals, a little re-enteringly curved, outer corners rounded. Side arm-plates, with spine-ridge not very prominent (though somewhat more than shown in the figures). There is a little naked space between the side arm-plates, not seen from the dorsal side. (Figure 5 is not correct in this respect.) The dorsal plates are thrice as broad as long, with outer edge slightly curved, a little concave on each side; inner sides almost straight, outer corners rather sharp; they are broadly in contact, the inner angle very obtuse, truncated. The under side of the arms flat, the dorsal side much rounded.

Disk covered with rather large, delicate, overlapping scales, among which the primary plates are more or less distinct (scarcely at all in the specimen figured). The radial shields pearseed-shaped, wholly separated by some few rather large scales; they are pointed within, their outer edge rather broad, straightly cut. Outside the radial shields are seen one or several narrow scales. The scales of the under side smaller than those of the dorsal side; usually there is one rather conspicuous scale joining the mouth shield. Genital scales not distinct. Margin of the disk convex, the edge rounded.

Three equal, short, thick arm-spines, scarcely longer than half the length of an arm-joint. Two (seldom three) small tentacle scales, rather irregularly arranged: that on the ventral plate is distinct only in the inner part of

the arm, and even here not on each joint; that on the side arm-plate, which is usually placed at the base of the lower arm-spine, may be distinct far out on the arm, but not to the end; sometimes, however, the latter scale is the first to disappear, sometimes only a few of the inner pores have tentacle scales at all.

Color in alcohol: gray.

Three specimens from Station 3374, 1823 f. One of the specimens has the mouth shields quite irregularly formed.

The two species, *A. Diomedeæ* and *A. assimilis*, appear to be nearly related to *A. chilensis* (M. & Tr.), or one of them may be identical with it; but nothing can be said with certainty about it before that species has been figured. LYMAN* has given a sketch of the mouth part of it, but he adds a query, so it is not to be relied upon. If it be right, *A. Diomedeæ* and *A. assimilis* are not nearly related to this species.

34. Amphiura dalea Lym.

Plate XII. Figs. 8-12.

LYMAN. Challenger Ophiuroidea, p. 137, Plate XVIII. Figs. 11–13.

To this species we refer three specimens from Station 3361, 1471 f., and one from 3414, 2232 f. As there are, however, certain differences from LYMAN's figures, we have thought it best to give figures of our specimens also.

LYMAN says there are three mouth papillæ on each side, besides those on the apex. In our specimens there appears to be the same number of mouth papillæ; however it is clear, especially in the smallest specimen, that the inner one of these three papillæ does really belong to the first mouth tentacle, thus corresponding to the papilla seen in this place in other species of *Amphiura*, and which is not reckoned among the true mouth papillæ. The form of the mouth shield is very like that seen in LYMAN's figures; in one specimen it has the form seen in Figure 8 a. The ventral plates in our figure are rather different from those in LYMAN's figure; nor does his description, "broader than long, angular, and with re-entering curves on the sides, where are the tentacle pores," correspond very well therewith. As there is, however, some variation in regard to their form, the outer edge being sometimes

* Ophiuridæ and Astrophytidæ of the Hassler Expedition. Ill. Cat. Mus. Comp. Zoöl., No. VIII., Part II. Plate V. Fig. 77.

rounded or almost straight, much stress cannot be laid upon that difference. The naked space which separates the side arm-plates is not mentioned by LYMAN, nor seen in his figure; it is not distinct from the dorsal side. All the primary plates are distinct, but small; LYMAN mentions only the central plate. Along the outer edge of the radial shields there are one or more narrow scales. The inner arm-joints have 4–6 spines. In regard to the tentacle scales, they correspond in the curious fact that such are found only on a few of the inner joints. In one specimen they had the form seen in Figure 11.

Our specimens are larger than LYMAN's, the largest being 15 mm. in diameter of disk. The arms are broken.

LYMAN's specimens were taken in the Atlantic, Lat. 36° 44′ S., Long. 46° 16′ W., 2650 f., gray mud.

35. **Amphiura granulata** n. sp.

Plate X. Figs. 1-4.

Diometer of disk, 6 mm.; width of arm close to disk, 1 mm.; length of arms, c. 9 times the diameter of the disk. Two mouth papillæ on each side, making a continuous row with those on the apex; the outer one is the widest; both are flat and rounded. Mouth shield rhomboidal, with an acute angle within, the sides a little re-enteringly curved, corners rather sharp. Side mouth shields somewhat curved, outer end a little broader than the inner end where they meet.

First ventral plate very small, thick, and swollen, forming a little tubercle at the outer end of the mouth slit. Those beyond inconsiderably more wide than long, all more or less distinctly separated. They have an angle within, outer edge doubly curved, with a cut in the median line; inner laterals re-enteringly curved, outer almost straight; outer corners rounded. A feeble keel along the median line. The side arm-plates with rather prominent spine-ridge (not sufficiently prominent in the figure). No naked space separating the side arm-plates distinct. Dorsal plates twice as broad as long, rather broadly in contact; with an obtuse truncated angle within, sides feebly curved, outer corners sharply cut (not sufficiently distinct in the figure). A feeble keel along the upper side of the arm.

Dorsal side of the disk covered with small, delicate, overlapping scales, among which the primary plates are not distinct; along the margin are

usually seen some irregular scales, a little larger than the others (not seen in the figure). The radial shields are not half as long as the radius of the disk, in contact in their outer half, their inner ends separated by more irregularly arranged scales; they are pointed within, truncated without. Usually no scales are seen outside the radial shields. Under side of the disk covered with a close granulation, only just outside the mouth shield may be seen some few scales. Inner end of the genital scales distinct. The margin of the disk is convex, the edge rather sharp.

Three equal, tapering arm-spines, about as long as an arm-joint. Two rounded tentacle scales, that on the ventral plate the larger.

Color in alcohol: white, the disk with a pale bluish tint (from the stomach).

One specimen from Station 3355, 182 f., 5 specimens numbered 8158.*

The radial shields in some specimens are rounded, almost wholly in contact, only their inner ends being separated by one small scale (Fig. 3). The primary plates may be distinct.

This species evidently belongs to what is commonly called *Ophiocnida*. However, we have named it *Amphiura*, as we think *Ophiocnida* to be an unnatural genus, spines or granules on the disk being too insufficient a character for founding a genus upon. The genus *Amphipholis* Ljungm. is much better defined, and LYMAN was scarcely right in including those forms in the genus *Amphiura*. Our *A. granulata* would be an *Amphipholis*.

Also the next two species, *A. gastracantha* and *A. notacantha*, would belong to *Ophiocnida* on account of the spines on the disk. LYMAN says (Challenger, p. 152), "*Ophiocnida* is *Amphiura* beset with small spines or grains, just as *Ophiactis* is *Amphiura* with short wide arms." He is only partly right in that; *Ophiocnida* is really *Amphiura*, it is true, but *Ophiactis* is very well separated from *Amphiura* by having a single (or no) infradental papilla, whereas *Amphiura* always has two.

36. Amphiura gastracantha n. sp.

Plate XIII. Figs. 4-6.

Diameter of disk, 8 mm.; width of arm close to disk, without spines, 1 mm.; length of arms, not known with certainty, but they are long and

* We have no information of what this number means.

slender, apparently about ten times the diameter of the disk. Three mouth papillæ on each side, besides those on the apex; the outermost is very small, rounded, the next two are long and pointed; inside these is seen another pointed papilla, almost on the level of the true mouth papillæ; it belongs to the first mouth tentacle. Mouth shield inconsiderably broader than long, inner end widely rounded, outer end restricted, corners rounded. Side mouth shields almost equally wide in their whole length, scarcely meeting within.

First ventral plate as broad as the following ones, but much shorter, hollowed within. Those beyond angular, a little longer than broad; they are rather broadly in contact in the inner part of the arm, and have thus the inner angle truncated; farther off they become separated, and then have an obtuse angle within. The outer edge is made of three lines, which form two obtuse angles; the median one of these lines is slightly concave, the two others straight. Inner laterals almost straight, outer re-enteringly curved; corners sharp. Side arm-plates with a rather prominent spine-ridge; there is a broad naked space separating the side plates of each two adjoining joints, also seen from the dorsal side. Dorsal plates a little more broad than long (the inner ones not as broad as those farther off); they are usually separated, but sometimes they are rather broadly in contact. They have a rounded angle within and outer edge curved; corners not rounded.

Disk covered with numerous small, smooth, overlapping scales, among which no primary plates are seen. The radial shields narrow, not half the length of the radius of the disk, just meeting without or wholly separated, without by a single elongated scale, within by some more irregularly placed scales; they are pointed within, outer edge straight. There are a few small scales outside the radial shields.. Under side of the disk covered along the margin with scales similar to those of the dorsal side, on the inner part more sparingly covered with scales, the naked skin being seen between them. Along the margin there are some short spines, a few of them seen from the dorsal side. Inner end of the genital scales distinct. Edge of the disk rounded, the margin slightly concave.

The inner joints have seven arm-spines; farther out they gradually diminish in number, and in the outer part of the arm there are only three. They are delicate, pointed, as long as an arm-joint or a little longer; the upper and the lower ones usually are a little longer than the rest. One small rounded tentacle scale; in the outer part of the arm there is none.

Color in alcohol: faintly bluish, mouth shields (except the madreporite) and radial shields with red spots; the arms, especially ventral and side plates, also reddish.

One specimen from Station 3418, 660 f.

37. Amphiura notacantha n. sp.

Plate XIII. Figs. 7-9.

This species so closely resembles the foregoing that a detailed description is quite unnecessary, as will be seen from a comparison of the figures. It will be sufficient to note the differences.

The disk is quite naked on the under side, only the genital scales are distinct. The dorsal side towards the margin with some few spines. The radial shields are longer, as long as half the radius of the disk, in contact in their outer part, their inner ends separated by several small irregular scales; they are a little curved; no red spots are seen.

One specimen (9 mm. diameter of disk) from Station 3424, 676 f.

From Stations 3393, 1020 f., and 3435, 859 f., there is one specimen from each, which appear to belong to one of these two species; but as they have lost the disk, it cannot be said with certainty to which of them they belong. Most likely it is the latter, because the species with naked under side are more liable to cast off the disk than those with scaled under side. Inconsiderable variations are seen in the form of the mouth papillæ and mouth shields.

38. Amphiura sp.

Plate XIII. Figs. 1-3.

From Station 3418, 660 f., there is a specimen of an *Amphiura* which appears to be a new species. It belongs to the group of *Amphiura* species with 5 mouth papillæ on each side (*A. cuneata* Lym., *A. tumida* Lym., *A. nereis* Lym., and the species figured by Lyman (76), Plate V. Figs. 64–66). It seems to be nearest related to *A. nereis*, but, as the disk is wholly wanting, it cannot be determined with certainty, nor can the description be complete.

The arms are thin and slender, about 80 mm., ten times or more the diameter of the disk. Four or five small, rounded, almost equal, close set mouth papillæ, besides those on the apex, which are the largest. Mouth shield

a little longer than wide, with a rounded peak within, outer part restricted; the sides much diverging on the inner, almost parallel on the middlle part; corners rounded. Side mouth shields a little broader without than within, where they meet.

First ventral plate very small, triangular, with outer edge curved. Those beyond with an acute angle within, which is inconsiderably truncated on the inner joints, where the plates are in contact; the outer edge is curved, inner and outer laterals almost straight, outer corners rounded; they are almost equally broad and long. Side arm-plates with spine-ridge not very prominent, a little naked space separating those of each two adjoining joints, not distinctly seen from the dorsal side. Dorsal plates transversely oval, more or less distinctly separated by the side arm-plates; less than twice as broad as long.

Three equal tapering arm-spines, about as long as an arm-joint. Two small rounded tentacle scales.

Presumably the under side of the disk is naked.

39. **Amphiura papillata** n. sp.

Plate XIV. Figs. 4-6.

Diameter of disk, 9 mm.; width of arms close to disk, without spines, 2 mm.; length of arms unknown. Five mouth papillæ on each side, besides those on the apex, all more or less pointed, conical, the outermost but one by far the largest; the rest almost equally large, those on the apex smaller than the others and placed a little higher up in the mouth. At their basis there are one or two (at the one mouth angle none) very small papillæ. Mouth shield inconsiderably more wide than long, with an almost right angle within, outer part restricted; inner sides straight or feebly curved, corners rounded. Side mouth shields rather long and unusually narrow in their whole length.

First ventral plate very small, triangular, with an acute angle within and outer edge curved. Those beyond somewhat wider than long, rather broadly in contact, their inner angle thus being truncated. Outer edge curved, inner and outer laterals re-enteringly curved; outer corners somewhat produced. Side arm-plates with spine-ridge little prominent; no naked space separating them. Dorsal plates broadly in contact, about twice as broad as long; inner side concave, outer side convex, twice as

wide as the former; lateral sides straight, outer corners rounded. The first dorsal plate shorter than those beyond, and inside that there are seen some very small, narrow, indistinct plates.

Dorsal side of the disk covered with small, rather thick, overlapping scales, among which the primary plates are scarcely seen. In the interbrachial spaces there is an irregular median row of a little larger scales, and along the margin there are also some more conspicuous scales, overlapping towards the radial shields. These are small, pearseed-shaped, scarcely as long as one third of the radius of the disk, widely separated by several irregularly arranged scales; their outer edge is straight; no scales outside them. Under side of the disk covered by scales of about the same size as those on the dorsal side, but curiously enough they usually overlap one another inwardly. The genital scale scarcely distinct. Along the genital slits there are some few papillæ, and usually one or two on the first side arm-plate. Along the margin of the disk are seen a few short spines, and over the arm-basis there are many small, irregularly arranged papillæ or spines. Margin of the disk a little concave; the edge rather sharp, the scaling of the dorsal and the ventral side being rather sharply set off from each other.

Three arm-spines, the middle one the longest, all a little longer than an arm-joint; they are rather thick at the basis, not pointed, and seen from above or below they are feebly curved. Two or three tentacle scales: one large, oval, on the side arm-plate, and two, farther out, one small, along the ventral plate.

Color in alcohol: gray.

One specimen from Station 3404, 385 f.

We have been not a little in doubt where to place this fine species, whether in the genus *Amphiura* or *Ophiochiton*. It appears to be rather nearly related to *A. nereis* Lym., but the rather robust structure is not *Amphiura*-like. Further, a comparison with the figures of *Ophiochiton carinatus* (Plate XIV. Figs. 1–3) shows a rather close resemblance to this genus. There is only one feature of any importance in which they differ: *A. papillata* has two infradental mouth papillæ, whereas it appears to be a character of *Ophiochiton* that it has only one infradental mouth papilla; however, that is not mentioned by LYMAN in his diagnosis of this genus. If that be right, *Ophiochiton modestus* Koehler (67) cannot belong to that genus, but should perhaps be referred to *Amphiura*, as it is now defined.

Evidently this very large genus needs to be subdivided, and then such forms as *A. nereis*, *papillata*, (and *modesta*?) perhaps would form a separate genus.

40. Amphilepis patens Lym.

Plate X. Figs. 8–10.

LYMAN: Challenger Ophiuroidea, p. 149, Plate XIX. Figs. 1–3.

To this species we refer, with some little doubt, a specimen from Station 3414, 2232 f. The *A. patens* Lym. was taken between Valparaiso and Juan Fernandez (2160 f.); thus the locality seems to indicate that they are identical. There are however some rather important differences, which make the identification somewhat doubtful; we therefore have thought it best to describe and figure our specimen.

Diameter of disk, 7.5 mm.; width of arms close to disk, 1.3 mm.; length of arms unknown. Three close set papillæ on each side of the mouth angle, short but broad; at the apex, between the inner pair of papillæ, is seen the lowest tooth, or mouth papilla. At the pore of the second mouth tentacle are seen two small scales or papillæ, inserted on the side mouth shields. (Not in LYMAN'S specimens.) These latter papillæ alone correspond to the true mouth papillæ in *Amphiura;* those along the mouth slit correspond to that seen a little higher up in the mouth in *Amphiura*, but which is not there reckoned among the true mouth papillæ. Mouth shield triangular, with an acute angle inwards, outer corners rounded, the sides almost straight; a little more broad than long. Side mouth-shields broader without than within, where they meet.

First ventral plate small, rounded; the second has inner angle truncated, outer edge doubly curved (not in LYMAN'S figure), a little more broad than long. Those beyond all distinctly separated (though scarcely so much as in the figure), almost twice as broad as long; they have all a very obtuse angle within, and outer edge curved; inner and outer laterals re-enteringly curved. Side arm-plates with spine ridge rather prominent (more than in the figure). There is a naked space separating the side arm-plates of each two adjoining joints, not seen from the dorsal side. Dorsal plates transversely oval, twice as broad as long, not in mutual contact; the inner one is rudimentary.

The disk is covered on the dorsal side with rather large, delicate, overlapping scales, among which the primary plates are distinct. Along the

margin there are some more conspicuous plates. The radial shields are half as long as the radius of the disk, wholly separated by a few rather large scales; the adradial edge almost straight, the abradial curved; inner end more or less pointed, outer end rounded. Outside the radial shields there may be a very small, narrow scale (not in the figure). Under side of the disk covered with scales, much smaller than those on the dorsal side. The genital scale distinct in most of the length; it appears to be divided after the length, but in the single specimen we could not make that clear without injuring it. (Seen on the left side in Figure 8.) The margin of the disk convex, the edge rather sharp.

Three equal, tapering arm-spines, not quite as long as an arm-joint (they are rather too pointed in the figures). One small tentacle scale at the inner corner of the pore (in LYMAN's specimen on the lateral side of the ventral plate); the first pair of pores without tentacle scale (not in LYMAN's figure).

Color in alcohol: white.

41. Ophionereis annulata Lym.

Plate XIII. Fig. 11.

LYMAN: Illust. Catalogue Mus. Comp. Zoöl., No. I. p. 143.
" Challenger Ophiuroidea, p. 162.

Of this species there are two fine specimens from Panama. In Figures 10, 11, is shown a view of the dorsal side of the arm of this species, and of *O. reticulata* Ltk. The inner and outer edge of the dorsal plate is a little wider in the latter species, which seems to be the sole difference between these two species, besides the coloring of the disk. At any rate, they are very closely related, perhaps identical.

From Station 3405, 53 f., there is a single arm of a large *Ophionereis* (Plate XIII. Fig. 12), whose very wide dorsal plates and very small supplementary plates seem to indicate a new species. It is finely colored: along the dorsal median line there are some small, irregular, dark brown spots; at the margin there is a large dark brown spot on two joints, then two joints without dark color, and so forth, regularly alternating. There are three arm-spines; the ventral side of the arm as usually in *Ophionereis*.

42. Ophionereis nuda n. sp.

Plate XIV. Figs. 7-9.

Diameter of disk, 8 mm.; width of arm close to disk, without spines, 1.7 mm.; length of arms, about ten times the diameter of the disk. Five mouth papillæ on each side, rather long, more or less conical, the outer one a little apart, being the most pointed. At the apex there may be a very small papilla. Mouth shield a little broader than long, with a rounded peak within, restricted at the outer end; outer edge straight, inner sides curved, corners rounded. Side mouth shields very narrow, scarcely meeting within, a little broader at their outer end.

First ventral plate small, with outer edge curved, inner edge and sides almost straight. Those beyond a little longer than wide; all broadly in contact, with inner angle truncated, outer edge curved or straight on the first two joints, from the third, concave. Outer corners rounded; inner laterals very short, outer long, both re-enteringly curved. Side arm-plates with spine-ridge not very prominent; there is a naked space separating the side plates of each two adjoining joints. Dorsal plates with inner edge about twice as wide as the outer; the supplementary plates very conspicuous.

The disk is naked above and below; only along the abradial side of radial shields there is a little space covered with small scales, which extends farther inwards from the inner end about as far as their length. Besides these, there are no scales at all on the disk. The radial shields are very small, elongated-triangular, widely separated. The genital scales are rather distinct, beset with few small papillæ.

Three rather thick, somewhat curved arm-spines, a little longer than an arm-joint, the upper one a little shorter than the others. One large, oval tentacle scale.

Color in alcohol: brown; the arms in the one specimen uniformly brown, in the other with a dark brown spot on the side plate of each fifth joint, the other joints being light brown or whitish.

Two specimens from Stations 3397, 85 f., and 3405, 53 f.

This species apparently is nearly related to *Ophiotriton Semoni* Doederlein (28), (p. 288, Taf. XV. Fig. 8 u. 8 a). We have not named it *Ophiotriton*, but *Ophionereis*, as we do not think it necessary to make a separate genus of those species with a naked skin. (Upon this character alone *Ophiotriton* was

founded.) In *O. Semoni* only the arm-plates and the middle of the mouth shield is uncovered; in *O. nuda* the whole mouth region and the radial shields are uncovered, besides the arms. The small scales along the radial shields recall those of other species of *Ophionereis*. The covering of the disk evidently is very variable in this genus, the species forming a series from the rather coarse-scaled *O. fusca* Brock, through such forms as *O. reticulata* Ltk. and *O. nuda* to *O. Semoni*.

43. Ophiochiton carinatus n. sp.

Plate XIV. Figs. 1-3.

Diameter of disk, 13 mm.; width of arm close to disk, 2.8 mm.; length of arm, about 10–11 times the diameter of the disk. Five or six rather long, conical mouth papillæ on each side, the outermost but one much larger than the rest; one conical at the apex. Mouth angles rather long. Mouth shield wider than long, with an obtuse rounded angle within, inner sides slightly, outer sides much re-enteringly curved; corners and outer edge rounded. Side mouth shields very narrow, not meeting within; their outer end is a little widened.

First ventral plate very small, six-sided. Those beyond wider than long, rather broadly in contact to the end of the arm. Inner angle truncated, outer edge with a rounded median peak, re-enteringly curved towards each side; inner and outer laterals concave, outer corners produced. A very distinct sharp keel along the median line of the ventral plates, only disappearing towards the end of the arm. Side arm-plates with spine-ridge not very prominent, not meeting below, and above only at the end of the arm. Dorsal plates a little wider than long, four-sided; the inner edge scarcely half as broad as the outer, the former concave, the latter strongly curved (or with a rounded peak); lateral sides straight, outer corners sharp. At the base of the arm there are some quite rudimentary dorsal plates and many very small scales besides. Dorsal side of the arm with an indistinct keel.

Disk covered with very small, overlapping scales, among which the primary plates are conspicuous. In the interbrachial spaces there are some larger scales along the margin, overlapping towards the radial shields. These are scarcely half as long as the radius of the disk, and half as broad as long; their adradial edge is slightly, the abradial edge much curved; a rounded peak within, outer edge straight; they are wholly separated by

many small scales. Outside the radial shields there is a narrow band of very small scales. Under side of the disk covered by small, overlapping scales, which are somewhat projecting, giving the under side a rather curious aspect. Several larger plates are seen among the small ones, besides a row of larger scales along the margin. Genital scale distinct in the whole length, the inner end covered by small, overlapping scales. The margin has a little median cut in each interbrachial space; the edge of the disk is rather sharp.

Three, on the inner joints four, rather thick, a little curved arm-spines; about as long as one joint and a half or two joints. Sometimes they are equal, sometimes the upper one is a little longer. Two large, oval tentacle scales, that on the outer side the larger, more or less covering that on the inner side, which is inserted on the ventral plate.

Color in alcohol: dark gray.

Stations 3354, 322 f.; 3356, 546 f.; and 3394, 511 f.; one specimen from each station. That from Station 3356 is very large (diameter of disk, 27 mm.), but badly preserved. The spines are more flat, especially the lower one on the joints enclosed in the disk. The arm is higher and the dorsal plates are broader than in the specimen described. On the inner free joints the upper arm-spine is as long as two joints and a half. The marginal plates are not distinct. The scales of the under side are so small that it appears almost naked. The same is the case in the third specimen. In these two specimens the side mouth shields meet within, and are equally broad in their whole length.

OPHIACANTHA.

In this genus the spines of the disk are of no little systematic importance. LYMAN distinguishes grains, spines, stumps or crotchets; as there are, however, transitional forms (e. g. "grain-like stumps"), it is often difficult to determine to which of these sorts the spines, etc. in specimens under examination belong. This difficulty is easily overcome when the spines, etc. of every species are figured. This we have done here with our species, and it should be done in the future by every one who may describe species of *Ophiacantha*. Also those of the species already known should be figured, if there is occasion.

44. Ophiacantha cosmica Lym.

Plate XV. Figs. 1-3.

LYMAN: Challenger Ophiuroidea, p. 194, Plate XIII. Figs. 13–15.

Of this species there are several specimens from Stations 3360, 1672 f.; 3381, 1772 f.; 3382, 1793 f.; and 3414, 2232 f.

Though in general accordance with LYMAN's description, there are several small differences to be noted. The first ventral plate sometimes has the form shown in our figure, but usually that seen in LYMAN's figure; those beyond have a more or less distinct median cut in the outer edge. Tentacle scales usually on the inner joints only; in LYMAN's figure they are of a form uncommon in *Ophiacantha*, and are inserted on the side of the ventral plate, but this is not in accordance with his description, so the figure may be incorrect in this respect. The spines of the disk (Fig. 3) are about 0.8 mm. long. LYMAN says they are "composed of five or six thorns, of different lengths, soldered side by side." This description seems not to be inconsistent with the figure here given. They continue on the 6–8 inner dorsal plates, along their outer edge, not spread on the plates, as on LYMAN's figure. The arm-spines are shorter than in LYMAN's specimens, the longest being scarcely as long as two arm-joints, and they are finely but distinctly thorny. These differences we do not think to be sufficient to found a new species or variety upon. The most important difference may be that in regard to the arm-spines; but their number is the same. Of far greater importance evidently is the feature of the papillæ outside the true mouth papillæ, in which they correspond, a feature also found in *O. rosea* Lym. and *O. scutata* Lym., and which gives a rather curious aspect to the mouth.

One specimen has only four arms.

45. Ophiacantha pacifica n. sp.

Plate XV. Figs. 4-6, Plate XVI. Fig. 11.

Diameter of disk, 12 mm.; width of arm close to disk, without spines, 2 mm.; length of arms, about five times the diameter of the disk. 3–4 rather large, more or less pointed mouth papillæ on each side; that on the apex usually very broad. Close to the first ventral plate is seen something like a papilla (at the adradial side of the outer mouth tentacle), but it is not a

real papilla, as it is not separated from the mouth skeleton. (The same is seen in most of the *Ophiacantha* species, more or less developed.) Mouth shield very broad, triangular, more than twice as broad as long; a very obtuse angle within, side corners very acute, a little rounded at the tip; inner sides irregularly curved, outer sides almost straight, as is the outer edge; usually the whole outer side makes one straight line. Side mouth shields rather broad, meeting within; their inner side irregularly curved. Mouth and side mouth shields quite flat, with sharp edges.

First ventral plate rather large, five-sided, with an angle within. The second is usually, but not always, in contact with the first, and has its acute inner angle truncated; almost as long as broad. Those beyond all widely separated, with an obtuse angle within; considerably broader than long. The second and third have the outer edge a little re-enteringly curved, those beyond simply curved; inner and outer laterals re-enteringly curved. Side arm-plates with spine-ridge rather prominent. Dorsal plates rhomboidal, the second sometimes with inner angle truncated, those beyond widely separated; all the sides are a little curved, and all four angles rather sharp; sometimes the outer edge is simply curved, and the plates are then almost triangular; they are about equally long and broad. The arms are not much knotted, the joints being inconsiderably constricted.

Disk wholly covered with a dense coat of small, slender spines, c. 0.4 mm. long, with a crown of 3–5 thorns (Plate XVI. Fig. 11); also on the dorsal side of the first free arm-joints such spines may be found. On the under side of the disk the scales usually are seen beneath the spines. The radial shields are wholly covered, but appear as indistinct, little elevated ribs.

Five slender, smooth arm-spines, the two upper ones the longest, as long as three arm-joints, the three lower ones much shorter, only about as long as one joint. Farther out they are all only about as long as one joint. Sometimes there are 7–9 spines on the inner joints, and they may form an almost continuous series over the dorsal side of the second joint. One pointed, spine-like tentacle scale.

Color in alcohol: pale gray.

Several specimens from Station 3398, 1573 f.

A rather fragile species.

46. Ophiacantha inconspicua n. sp.

Plate XV. Figs. 7-11.

Diameter of disk, 7 mm.; width of arms close to disk, without spines, 2 mm.; length of arms about six times the diameter of the disk. Three rather broad conical mouth papillæ on each side of the mouth angle; that on the apex not much larger than the rest. Mouth shield broader than long, triangular, with an obtuse inner angle, side corners rounded; inner sides concave, outer edge curved. Side mouth shields meeting within, equally broad in their whole length, a little curved.

First ventral plate six-sided; the second sometimes in contact with the first, those beyond widely separated; scarcely as broad as long. They have an obtuse angle within, outer edge strongly curved, sometimes with a median cut or a little concave; inner laterals almost straight, outer concave. Side arm-plates with rather prominent spine-ridge; there is a narrow, not very distinct, naked space separating those of each two adjoining joints. Dorsal plates all more or less widely separated, with an angle within, and outer edge curved; broader than long. Arms not knotted, the joints being inconsiderably constricted.

Disk covered with small grain-like stumps (Fig. 11, *a–c*), about 0.1–2 mm. long, usually ending in three thorns, which are each provided with a pair of smaller ones. In one specimen (Station 3357), there are a few spines of another shape (Fig. 11, *b*) among the common ones. The scales of the disk are seen beneath the stumps. On the under side of the disk the same stumps are found, but much more sparingly. The radial shields appear as long, rather elevated ribs or ridges, almost reaching the centre of the disk; their outer end is uncovered, and they are widely separated from one another.

Six smooth arm-spines, on the inner joints 7–8. On the second joint they form an almost continuous series over the dorsal side of the arm, farther out they are widely separated above, and finely arranged along the sides of the arm, a little curved (Fig. 9). The upper one is short and slender, except on the two inner joints, the next two are much the longest, as long as two–three arm-joints; the three (four) lower ones are little longer than an arm-joint. One large oval pointed tentacle scale.

Color in alcohol: pale gray.

Several specimens from Stations 3357, 782 f.; 3393, 1020 f.; 3407, 885 f.; and 3408, 684 f.

From Station 3404, 385 f., there is a young specimen of an *Ophiacantha* 3 mm. diameter of disk, which has much resemblance to *O. inconspicua* (mouth region, ventral plates, tentacle scales), but differs from that species in the knotted arms; the spines of the disk are as Figure 11, *b*. From *O. moniliformis*, which it resembles in the knotted arms, it differs in regard to the mouth shield and the ventral plates. It also very much resembles the *O. pentacrinus* Ltk., but differs from that species through its smooth spines. It may be really that species, but it seems too hazardous to assert upon such scanty material that this species lives both in the Atlantic and the Pacific Ocean.

47. Ophiacantha spinifera n. sp.

Plate XVI. Fig. 9, Plate XVII. Figs. 1-3.

Diameter of disk, 9 mm.; width of arms close to disk, without spines, 2 mm.; length of arms 4–5 times the diameter of the disk. Three rather long conical mouth papillæ on each side of the mouth angle, that on the apex not much wider than the rest. Mouth shield about twice as broad as long, with a rounded peak within and without, inner and outer sides re-enteringly curved, side corners rounded. Side mouth shields a little broader within than without, a little curved; they scarcely meet within.

First ventral plate small, with outer edge much rounded, inner side a little concave. The second usually in contact with the first, those beyond widely separated; they have a very obtuse angle within, outer edge curved, with a feeble re-entering curve in the median line; inner and outer laterals almost straight, outer corners rounded, except on the second plate. The inner ones are a little more broad than long, farther out they are equally broad and long. Side arm-plates with spine-ridge rather prominent. Dorsal plates triangular, with outer edge curved, separated, except on the two inner joints. The inner angle is rounded; they are about equally broad and long.

The disk is covered by stout, 0.6–0.7 mm. long stumps, which end in three–five thorns (Plate XVI. Fig. 9); a few stumps sometimes are found on the dorsal side of the first free arm-joint. The outer end of the radial shields is uncovered; they do not form ridges. The scaling is rather distinct be-

neath the stumps. On the under side of the disk there are stumps only on the outer part, on the inner part the scales are naked. Genital scales not distinct.

Six or five arm-spines, farther out only four; they do not form a continuous series over the dorsal side of the inner joints. The upper one is much the longest, about as long as three arm-joints, on the inner part of the arm; farther out it is not much longer than the others. Downwards they gradually diminish in length, the lowest being scarcely as long as one arm-joint. They are feebly thorny, the upper ones almost smooth. One rather large oval pointed tentacle scale.

Color in alcohol: gray.

Ten specimens from Stations 3356, 546 f., and 3393, 1020 f.

48. Ophiacantha Normani Lym.

Plate XVI. Figs. 1-4.

Ophiacantha Normani. Lyman: Preliminary Report of the Challenger Ophiuroidea. Part II. Bull. Mus. Comp. Zoöl., Vol. VI. No. 2, p. 58. Plate XV. Figs. 414–416.
Ophiomitra normani. " Challenger Ophiuroidea, p. 208. Plate XXVI. Figs. 9–11.

Of this species there are numerous specimens from Stations 3432, 1421 f. (one young specimen); 3435, 859 f.; and 3436, 905 f.

As our specimens show several differences from the figures given by Lyman, we have deemed it best to give figures also. The differences are as follows.

The mouth papillæ are all cylindrical in Lyman's figure; in our specimens that on the apex is broad and flat, and sometimes the two adjoining papillæ are likewise so. At the pore of the second mouth tentacle there is a more or less distinct small rounded papilla. Sometimes there are more papillæ crowded at the apex. The mouth shield, according to Lyman, is "a little broader than long," in our specimens it is twice as broad as long, and so it is also represented in Lyman's figure. Its sides are all slightly concave, or the outer sides are straight or a little curved. The side mouth shields sometimes meet within.

The ventral plates are rather different from those in Lyman's figure, especially the second, which has usually the outer edge a little concave. Often all the ventral plates have a little re-entering curve or median cut in the outer edge. The second is about equally broad and long, farther out

they become much broader (Figure 2 gives them scarcely broad enough). The dorsal plates have, according to LYMAN, a blunt angle within; in our specimens they have the inner angle truncated in about the inner half of the arm, being rather broadly in contact. The grains of the disk are rounded, according to LYMAN (not figured separately); in our specimens they are a little pointed, ending in a few small spines (Fig. 4). These grains are found along the outer edge of the dorsal plates far out on the arm, sometimes almost to the end. LYMAN says that only the first three or four are provided with grains; his figure, however, shows them on the first six plates (all that are figured).

The two upper arm-spines are, according to LYMAN, as long as a joint and a half, but his figures are far better in accordance with our specimens, where the upper one is as long as three arm-joints, the next much shorter; farther out also the upper one is somewhat shorter. The tentacle scale is pointed, a little curved.

There are thus not a few differences to be noted between our specimens and LYMAN's, judging from his figures and description. However, all these differences are rather unimportant, and may partly depend on a slight inaccuracy by LYMAN. In any case they seem to us too insufficient for founding a new species upon.

O. Normani was taken by the "Challenger" in the Eastern Pacific; it has thus a very wide distribution.

LYMAN originally placed this species in the genus *Ophiacantha;* later he transferred it to *Ophiomitra.* We cannot agree with him in this, and have replaced it in the genus *Ophiacantha.* Moreover, we find *Ophiomitra* a very ill defined genus, which can scarcely be upheld, at any rate in its present state. However we shall not at present say more about it, as we lack sufficient material of such forms.

49. Ophiacantha moniliformis n. sp.

Plate XVI. Figs. 5-8.

Diameter of disk, 5 mm.; width of arm close to disk, without spines, 1 mm.; length of arms c. 6 times the diameter of the disk. Three–four conical mouth papillæ on each side of the mouth angle; that on the apex much larger. Mouth shield almost cruciform, with all angles rounded, a little broader than long; inner and outer sides concave. Sometimes

there is a spine at the outer angle. Side mouth shields broad, meeting within.

First ventral plate rather large, with a truncated angle within, outer edge almost straight. Those beyond very widely separated; they have a very small peak within, the inner laterals making almost a straight line across the arm; outer laterals a little concave, outer edge strongly curved, outer corners rather sharp. They are very short, twice as broad as long, only the second is a little longer than the rest. Side arm-plates very long, with spine-ridge very prominent. Dorsal plates small, triangular, with outer edge rounded; almost equally broad and long, very widely separated. Arms slender, very much knotted, the joints being deeply restricted at the inner end, thick at the outer end, where ventral and dorsal plates are.

Disk densely covered, above and below by very small grains or stumps, about 0.1 mm. long, which end in a few spines (Fig. 8). The outer end of the radial shields is uncovered, in mutual contact, their inner ends are rounded, diverging; they do not make very prominent ridges. The outer end of the radial shields directed somewhat upward, being thus a considerable distance from the dorsal side of the arm. Perhaps this is an unnatural condition, but it is seen in all our specimens.

Five–four slender smooth arm-spines, farther out only three. On the second joint the two upper spines are as long as 3–4 arm-joints, the lower only as long as one joint. Farther out they rapidly diminish in length, and from the 7th or 8th joint also the upper spine is only about as long as one arm-joint. One very small spine-like tentacle scale.

Color in alcohol: gray.

Several specimens from Stations 3417, 493 f.; 3424, 676 f.; and 3425, 680 f.

50. Ophiacantha costata n. sp.

Plate XVI. Fig. 10, Plate XVII. Figs. 4-6.

Diameter of disk, 7 mm.; width of arms close to disk, without spines, 1.5 mm.; length of arms about five times the diameter of the disk. Three–five conical, finely thorny mouth papillæ to each side of mouth angle; that on the apex a little larger. Mouth shield almost twice as broad as long, with an obtuse angle within and without, or with the whole outer edge simply rounded; side corners produced, inner (and outer) sides concave. Side mouth shields broad, meeting within, a little curved.

First ventral plate rather large, six-sided or almost round. The second is broadly in contact with the first, those beyond all widely separated, with an obtuse angle within. They have the outer edge curved, with a little median cut; inner and outer laterals almost straight, outer corners rounded. They are about as long as broad; as a whole they are smaller than common in *Ophiacantha*. Side arm-plates with spine-ridge rather prominent. The dorsal plates rhomboidal or triangular, according to the more or less strong curve of the outer edge; inner angle broadly rounded, side corners sharp. They are widely separated; however the side arm-plates do not meet above till towards the end of the arm, being separated by a naked space, in which there may be small separate plates developed. The arms appear somewhat knotted, the joints being a little constricted; they are much rolled up in our specimens.

The disk is wholly covered above and below by rather large grains, which end in some small thorns (Plate XVI. Fig. 10). Also on the first arm-joint some such grains are found. The radial shields are wholly covered, but appear as elevated ridges. At their outer end there is a little space covered with naked skin. The inner end of the genital scales distinct.

Seven–six short, rather thick, thorny arm-spines, the upper one the longest, scarcely longer than an arm-joint, the lower one not half as long as an arm-joint; farther out also the upper one becomes shorter. One very small, spine-like tentacle scale, that at the first pore placed nearer to the median line of the arm, a little apart from the pore.

Color in alcohol: grayish.

Several specimens from Stations 3353, 695 f.; 3424, 676 f.; and 3425, 680 f.

This species appears to be rather nearly related to *O. discoidea* Lym., from which it is, however, easily distinguished.

51. Ophiacantha contigua n. sp.

Plate XVI. Fig. 12, Plate XVII. Figs. 7-9.

Diameter of disk, 5 mm.; width of arm close to disk, without spines, 1 mm.; length of arms about five times the diameter of the disk. 4–5 more or less conical mouth papillæ on each side; that on the apex not much larger than the rest. Mouth shield equally broad and long, triangular, with a lobe

without; inner angle obtuse, inner sides straight, corners rounded; the outer lobe has a little impression. Side mouth shields straight, almost equally broad in their whole length, meeting within.

First ventral plate rather large, outer edge strongly curved, the sides deeply concave. Those beyond are broadly in contact until about the 8th to 10th joint, farther out they have an obtuse angle within; outer edge curved, inner and outer laterals re-enteringly curved, outer corners rather sharp. They are almost equally broad and long. Side arm-plates with spine-ridge rather prominent. Dorsal plates all separated, rhomboidal or triangular (according to the more or less strong curve of the outer edge), about as broad as long. Arms not distinctly knotted.

Disk covered with stout rough stumps, c. 0.4 mm. long (Plate XVI. Fig. 12), which are not so close set as to hide the scaling of the disk completely. The radial shields are uncovered, small, triangular, separated by one or more rather large scales. Ventral side of the disk finely scaled, almost wholly without stumps, only along the margin a few are seen. Genital scale can be seen at the outer end of the slit.

Six arm-spines, on the inner joints seven, farther out only five; they are feebly thorny at the end. The upper ones not much longer than the lower, as long as $1\frac{1}{2}$–2 arm-joints; farther out they are only a little shorter, which gives the arm a rather coarse aspect. On the first free joint they form an almost continual series over the dorsal side of the arm. The two–three first pairs of pores have two tentacle scales, those beyond only one, large, oval.

Color in alcohol: pale gray-white.

Four specimens from Station 3380, 899 f.

52. **Ophiacantha hirta** n. sp.

Plate XVIII. Figs. 5-8.

Diameter of disk, 11 mm.; width of arm close to disk, without spines, 2 mm.; length of arms unknown, but evidently the same as usual in *Ophiacantha*. Six conical mouth papillæ on each side of the somewhat elongated mouth angle; that on the apex not distinctly larger than the rest. Mouth shield with an obtuse angle within, a broad lobe without, inner sides concave, side corners rounded; more broad than long. Side mouth shields more broad within than without; inner ends rounded, meeting broadly.

First ventral plate large, with outer edge curved, inner sides concave. Those beyond in contact far out on the arm (to the end?), but only the two–three inner ones have the inner angle truncated, the rest have an obtuse angle within. The outer edge is curved, farther out usually with a little re-entering curve in the median line, inner and outer laterals re-enteringly curved, outer corners a little rounded. The inner ones are about equally broad and long, farther out they are distinctly longer than broad. Side arm-plates with prominent spine-ridge; there is a little naked space separating those of each two adjoining joints, but it is not very distinct. Dorsal plates rhomboidal or triangular with outer edge curved; they are in contact more or less far out on the arm; in this respect there is some variation. Arms not knotted.

Disk densely covered with long, slender smooth spines, which end in three long thorns (Fig. 8), c. 1 mm. long. Mostly the outer end of the radial shields is uncovered; they do not form ridges. Ventral side of the disk covered by spines only along the margin, on the inner part the delicate overlapping scales are uncovered. Genital scales not distinct.

Five delicate, translucent, finely thorned arm-spines; the second from above is the longest, about as long as $1\frac{1}{2}$–2 joints, those below gradually shorter, about as long as one arm-joint. The length of the spines does not greatly diminish on the inner half of the arm; they do not form a continual series over the dorsal side of the first free joint. The first one to three pairs of pores have two elongated tentacle scales, those beyond one, rather large, pointed, which is however not so large as wholly to cover the tentacle pore.

Color in alcohol: brown.

Stations 3425, 680 f., and 3430, 852 f.; one specimen from each.

53. Ophiacantha paucispina n. sp.

Plate XVIII. Figs. 1-4.

Diameter of disk, 18 mm.; width of arm close to disk, 3 mm.; length of arms about four times the diameter of the disk. 7–8 rather thick, small, not pointed mouth papillæ on each side of the elongated mouth angle; that on the apex not much larger than the rest. They are often rather irregularly arranged; sometimes the outer one is apart from the rest, sometimes there are more papillæ crowded at the apex. Mouth shield broader than long,

with a little peak within and a rather broad lobe without. The corners are very largely rounded, inner and outer sides concave. Side mouth shields very narrow in the middle, broader, rounded at the inner end, where they scarcely meet, broadest without.

First ventral plate almost as large as the rest, five-sided, with outer edge straight. Those beyond all distinctly, but not widely separated; they have a little peak or very obtuse angle within, the inner laterals forming an almost straight line across the arm; sometimes the peak wholly disappears. Outer edge rounded, with a little median cut, outer corners rounded, outer laterals long, re-enteringly curved. The inner plates are about equally broad and long, farther out they become considerably longer than broad. Side arm-plates with spine-ridge little prominent; a naked space separating those of each two adjoining joints rather distinct, also from the dorsal side. Dorsal plates triangular, a little more broad than long, with outer edge curved. On the inner 5 to 10 joints they have inner angle truncated, and are separated by a naked space, which also separates the side arm-plates. More or less of the inner dorsal plates are rudimentary, surrounded by naked skin; sometimes they are quite irregular, divided in small pieces. Arms not knotted.

Disk covered above and below by delicate overlapping scales, which bear some spread, simple, not thorny spines (Fig. 4), c. 0.5 mm. long. Sometimes also such spines are found on the inner arm-joints. The radial shields are uncovered, small, narrow, mostly a little curved, much diverging within; they are wholly separated by several small scales. There seems to be a rather thick skin covering the disk. Genital scales not distinct.

4 to 5 short, smooth arm-spines, about as long as a joint, the upper one a little longer. One very small, quite rudimentary, spine-like tentacle scale at the inner end of the large pores.

Color in alcohol: gray.

Stations 3361, 1471 f.; 3362, 1175 f.; and 3414, 2232 f.; one specimen from each.

This species is nearly related to *O. Bartletti* Lym., from which it is, however, easily distinguished by its tentacle scales; *O. Bartletti* has none. Especially the remarkably formed ventral plates are alike in these two species.

54. Ophiacantha Bairdi Lym.

Plate XVIII. Figs. 9-13.

LYMAN: (76), p. 256, Plate V. Figs. 70–72.

From Station 3431, 995 f., there is one specimen, which we refer to this species; it is fairly in accordance with LYMAN's description and figures. His figures are, however, not very elaborate; it is therefore necessary to give new figures of the species. A detailed description is not needed, but some few remarks may be made.

The number of the mouth papillæ is five or six on each side of the mouth angle. The form of mouth and side mouth shields may be seen on the figure; the latter are not at all seen in LYMAN's figure. The two or three first ventral plates are in mutual contact, and have thus the inner angle truncated; those beyond have an obtuse angle within; they are a little broader than long. The arms have a rather curious aspect, all the plates being deeply striated by curved ridges (Fig. 11); also in other Ophiurans this feature may be seen, but so distinctly as here we have never seen it.

The disk is closely covered above with short, thick spines (or elongated grains, LYMAN), among which some few longer are spread; on the ventral side of the disk the spines are not so close set, the scaling being not completely hidden. The longer spines are found only on the dorsal side. Also on the mouth angle some spines are seen. Their form is seen in Figure 13, *a*, *b*, the long ones are about 0.5 mm., the small ones scarcely half as long. The inner joints have seven arm-spines, farther out there are only five, and they are here scarcely as long as one arm-joint.

This species is thus found both in the Atlantic and the Pacific Oceans.

55. Ophiomitra* granifera n. sp.

Plate XIX. Figs. 9-12.

Diameter of disk, 11 mm.; width of arm close to disk, without spines, 2.5 mm.; length of arms about six times the diameter of the disk. Three more or less conical mouth papillæ on each side of mouth angle; the outer one usually the largest; that on the apex sometimes smaller, sometimes larger than the rest. Mouth shield with an obtuse angle within, outer edge

* About this genus, we refer to what has been said under *Ophiacantha Normani*.

curved, sometimes with a little median peak; inner sides concave, corners sharp; about twice as broad as long. Side mouth shields curved, broader within than without, meeting within.

First ventral plate small, outer edge convex, inner edge concave. The second sometimes in contact with the first, sometimes separated from it; those beyond all widely separated, twice as broad as long. There is a very obtuse angle within, the inner laterals forming an almost straight line across the arm; the outer edge has a little rounded peak on each side of the median line, rather complicately curved (Fig. 9); sometimes it is simply curved, with a more or less deep cut in the median line; outer corners rounded, outer laterals straight, inner laterals of the second plate re-enteringly curved, on those beyond slightly sigmoidly curved. Side arm-plates with spine-ridge very prominent. Sometimes the median end on the ventral side of the first side arm-plates is cut off as a little separate piece. Dorsal plates triangular with all sides curved; broader than long. The two inner ones in contact, with inner angle truncated. Arms not much knotted, the under side very flat or hollowed, with a feeble keel along the median line.

Disk beset with coarse c. 0.2–3 mm. long grains (Fig. 12), which do not hide the scaling. The radial shields uncovered, triangular, in contact at their outer end; scarcely longer than a third of the radius of the disk. There is a row of grains along their outer edge; also along the outer edge of the first two dorsal plates there are such grains. The under side of the disk more sparingly beset with grains. Genital scale not distinct.

Six rough arm-spines, with two rows of thorns; they are accordingly smooth as seen from within or without, rough seen from above or below. The upper one, or that next to it, is the longest, as long as 2–3 arm-joints; the lower one the shortest, scarcely as long as a joint. They stand almost at a right angle to the arm, and they are far from making a complete series over the dorsal side of the first free arm-joints. There is one large oval thick tentacle scale.

Color in alcohol: gray.

Stations 3424, 676 f. (13 specimens); and 3426, 146 f. (1 specimen).

56. Ophiomitra partita n. sp.

Plate XIX. Figs. 5-8.

Diameter of disk, 4.5 mm.; width of arm close to disk, without spines, 1 mm.; length of arms unknown, but apparently about five times the diameter of the disk. Three conical mouth papillæ on each side of the rather elongated mouth angle; that on the apex a little larger than the rest. Mouth shield broader than long, with an obtuse angle within and a little rounded peak without; corners rounded, inner and outer sides concave. Side mouth shields a little curved, almost equally broad in their whole length; a little rounded within, where they scarcely meet.

First ventral plate rather small, six-sided, or with outer edge curved. Those beyond all widely separated; the second broader than long, then they become gradually narrower, and are thus at last longer than broad. They have a very obtuse angle within, outer edge curved, with an incisure in the median line, scarcely seen on the inner ones, farther out very conspicuous. Inner laterals of second ventral plate concave, from the third slightly convex; outer laterals concave, outer corners rather sharp. Side arm-plates with spine-ridge not very prominent. Dorsal plates triangular, with outer edge curved, equally broad and long, widely separated.

Disk covered with delicate, overlapping scales, beset with spreading short (c. 0.1 mm.) stout spines, which end in three bifurcating thorns (Fig. 8, *a*, *b*). The radial shields uncovered, not half as long as the radius of the disk; they are oval, with outer edge almost straight, separated by a single row of large scales; some few spines along their outer edge. The ventral side covered with similar scales, but without spines. Genital scale not distinct.

Five rough, thorny arm-spines, which do not form a continuous series over the dorsal side of the first free joint; the uppermost but one on the second joint is the longest, a little longer than two arm-joints; farther out it becomes shorter. Downwards they gradually diminish in length, the lower one being not so long as a joint. One rather large, broad, pointed tentacle scale.

Color in alcohol: white.

One specimen from Station 3424, 676 f.

57. Ophiothamnus lævis n. sp.

Plate XIX. Figs. 1-4.

Diameter of disk, 4 mm.; width of arm close to disk, without spines, 1 mm.; length of arms about five times the diameter of the disk. Four flat, pointed mouth papillæ on each side, that on the apex a little larger; the outer one of a somewhat different shape, having a cut on the inner side. Perhaps it is not really a true mouth papilla. Mouth shield more broad than long, with an obtuse angle within and a broad lobe without; corners produced, sharp, inner sides slightly, outer deeply concave, outer edge straight. Side mouth shields broader within than without, meeting within.

First ventral plate rather large, five- or six-sided. Those beyond all widely separated, with a very obtuse angle within and outer edge slightly curved; inner laterals straight or a little curved, outer re-enteringly curved, outer corners produced, rather sharp. About twice as broad as long. Side arm-plates with spine-ridge rather prominent. Dorsal plates triangular, with outer edge curved, all widely separated, a little broader than long; the first one quite rudimentary. Arms distinctly knotted.

Disk almost wholly destitute of spines or grains, except on the scales in the middle of the dorsal side, where are seen some few round grains, like those of *Ophiomitra granifera*. The radial shields are very large, as long as two thirds of the radius of the disk; they are contiguous in most of their length, only the inner ends being separated by a single large scale; they are almost triangular, as broad as long; the outer edge is slightly curved. In the narrow interbrachial space there are some small scales, which in our specimen are deeply sunk, so that there is a deep ridge; but that may be an unnatural condition. The central part of the disk is covered with small overlapping scales. On the under side of the disk there are a few large plates; especially conspicuous are a usually symmetrical pair, which join the mouth shield.

The first free arm-joint has five to six arm-spines, which form a continuous series over the dorsal side; the next joint has four, those beyond only three; the upper one is as long as $1\frac{1}{2}$–2 joints, the others about as long as a joint; they are slender, feebly thorny. In the outer part of the arm the lower spine is hook-like (Fig. 4). One rather large oval tentacle scale; those on the first joint directed outwards.

Color in alcohol: gray.

One specimen from Station 3406, 551 f.

This species shows some resemblance to *Ophiothamnus remotus* Lym., from which it is, however, very easily distinguished. It is on account of that resemblance that we have placed it in the genus *Ophiothamnus*, which seems to be as ill defined as *Ophiomitra*. LYMAN thinks he has found characters of generic value in the internal structure (the genital plates); we are not convinced that he is right in this. He gives figures of the internal skeleton usually only of one species of each genus, but evidently that is too little to determine which characters are of generic, and which only of specific value.

58. Ophiothrix spiculata Leconte.

LYMAN: Challenger Ophiuroidea, p. 226.

Of this species there are six specimens from Panama.

59. Ophiothrix galapagensis n. sp.

Plate XX. Figs. 1-4.

Diameter of disk, 5 mm.; width of arm close to disk, without spines, 1 mm.; length of arms about 5 to 6 times the diameter of the disk. The vertical oval has 17–18 conical tooth papillæ; 5–6 in the median line, arranged in a single row, and 6 in each marginal row; the latter are a little longer than the median ones; the lower ones are very small, growing gradually longer upwards. 3–4 flat teeth with straight cutting edge; the upper one is the narrowest. Mouth shield twice as broad as long, with a peak within and without; corners rounded, inner and outer sides concave. Side mouth shields equally broad in their whole length, meeting within.

First ventral plate rather large, rounded; those beyond broadly in contact, inner angle thus truncated; outer edge curved on the second and third, farther out feebly concave. Inner and outer laterals slightly concave, outer corners truncated. The second ventral plate is longer than broad; those beyond rapidly grow broader, and just outside the disk they are broader than long, and they remain so almost to the end of the arm. Side arm-plates with rather prominent spine-ridge; there is a naked space separating those of each two adjoining joints. Dorsal plates rather broadly in contact, inner angle truncated; outer edge much rounded, lateral sides

slightly concave; their outer end is a little thickened; almost equally broad and long.

Disk covered with very small scales, which are scarcely seen beneath the covering of spines. These are of two sorts (Fig. 4, *a*, *b*); short, thick, smooth ones, which end usually in three thorns, c. 0.1 mm. long (a little shorter on the central part of the disk than towards the margin), and long, slender ones, c. 1 mm. long, feebly thorny in their whole length, ending in some few small close set thorns. The radial shields are very large, triangular, with outer edge slightly curved, the other sides straight; they just meet without, and the corners are here a little knotted. Their width is two thirds of their length, which is almost the same as the radius of the disk; they are without spines. The ventral side of the disk is naked on the inner part; along the margin there is a rather broad band of small scales, covered with spines of the small sort only. The margin of the disk not produced in the interbrachial spaces.

Five–six slender, translucent, serrated arm-spines, increasing in length towards the dorsal side; the lower one is only half as long, the upper almost three times as long as an arm-joint; sometimes, however, the uppermost one is much shorter, the next two then are the longest. From the fifth or sixth joint the lower arm-spine becomes hook-shaped, with 2 to 3 thorns. One small tentacle scale, except at the first pair of pores, which has none.

Color in alcohol: white, with a slight purplish tint, especially on the radial shields.

Four specimens from Station 3405, 53 f.; one of these has six arms.

60. Ophiomyxa panamensis n. sp.

Plate VII. Figs. 1-3.

Diameter of disk, 14 mm.; width of arm close to disk, 3 mm.; length of arms about six times the diameter of disk. Four mouth papillæ on each side of mouth angle, that on the apex a little larger than the rest; they are finely and irregularly serrate, but they have no transparent band along the margin as in other *Ophiomyxa* species. Below the first mouth tentacle are three spine-like papillæ. Mouth shield transversely oval, broader than long, with a rather indistinct peak within. Side mouth shields not meeting within.

First ventral plate rather large, six-sided, or with outer edge broadly curved. The second is in contact with the first, those beyond separated by

a five-sided naked space. They have a truncated angle within and a deep cut in the outer edge, thus bifurcating at the outer end; inner and outer laterals slightly concave. They are broader than long. Sometimes the inner end of the ventral plate is divided from the chief part of the plate. Side arm-plates with spine-ridge little prominent. Dorsal plates rhomboidal, twice as broad as long, in narrow mutual contact in the whole length of the arm; inner sides slightly concave, outer edge convex in the middle, concave towards the sides. (In fact, the dorsal plates are closely soldered with the arm-bones, and mostly consist of small, irregular, ill defined plates, which look like a single plate.) The plates are distinct only in dried specimens.

The disk is wholly naked,* except the radial shields and a single row of scales all round the margin; between the radial shields there are 4–5; in the interbrachial spaces there are about 15 or more, the number being rather variable. The radial shields are club-shaped, with a little interbrachial prolongation at the outer end; they are one fourth as long as the radius of the disk. Along the genital slits also is seen a row of overlapping scales, more or less distinct.

Four or five short, stout arm-spines, about as long as an arm-joint, the upper one the longest. No tentacle scale.

Color in alcohol: pale brown.

Several specimens from Station 3397, 85 f., and from Panama.

61. Sigsbeia lineata n. sp.

Plate XX. Figs. 5-8.

Diameter of disk, 7 mm.; width of arms close to disk, 2.5 mm.; length of arms about five times the diameter of the disk. (The rolling up of the arms makes the measuring somewhat inaccurate.) Four (three) mouth papillæ to each side of mouth angle, and one diamond-shaped at the apex; they are short and square, making a close line. That on the apex sometimes is separated from the oral pieces, the two papillæ at its sides joining in the median line (Fig. 5). Mouth shield semilunar, with a very little peak within and outer edge curved, sometimes a little restricted at the sides by the genital slits, but not with a peak without; it is much broader than long.

* Sometimes there are, however, some spread, irregular scales in the disk skin, seen only in dried specimens.

Side mouth shields very conspicuous, short and broad, meeting broadly within.

First and second ventral plate not so large as those beyond; outer edge curved, inner edge a little concave; those beyond with outer and inner edge straight; they all have laterals re-enteringly curved, and, except the first, outer corners rounded. They are much broader than long. From about the fifth joint the inner end of the ventral plates is deeply sunk, so that they appear separated, but are not so really; they are all broadly in contact. Side arm-plates short, but rather thick, the outer edge remarkably sinuous, where the arm-spines are inserted; they are separated above and below. Dorsal plates with outer edge strongly curved, inner angle truncated, sides straight; they are about equally broad and long, on the inner part of the arm somewhat broader (a little too broad in Figure 6). The two–three inner ones more or less rudimentary, separated from the radial shields by a row of 2–3 thick plates to each side and one median.

Disk very small. The radial shields separated by a single scale or some few large ones; in the interbrachial space there is only a single row of scales, but at the margin there are more small ones. Usually a rather large central plate and some smaller irregular ones around it. Primary plates sometimes distinct, sometimes not. The radial shields are a little more than half as long as the radius of the disk. All the plates of the dorsal side are thick and swollen, but perfectly smooth. The ventral side of the disk covered with much smaller irregular scales; genital scales small and inconspicuous. The genital slits very short, but distinct.

One large round tentacle scale. Three short, broad, flat arm-spines; the upper one especially has become very broad and large, so that it appears like a supplementary plate on each side arm-plate. Indeed, LYMAN regards it as such in *S. murrhina*. On paring it off, the side arm-plate of the next joint is seen beneath it, so there cannot be any doubt that it is really an unusually developed arm-spine.

Color in alcohol: white, with light brown bands on the dorsal side. Each arm has two longitudinal bands, one an each side of the dorsal plates. Those of two opposite arms are continuous over the disk, those of the other arms mostly united at the base of each arm. Finally, there is usually a little band in each interbrachial space.

Several specimens from Station 3405, 53 f.

This fine species is very nearly related to *S. murrhina* Lym., from the

West Indies, the most important difference being that the plates of the dorsal side are here perfectly smooth, whereas they are tuberculated in *S. murrhina*. Also the coloring is different.

62. Asteronyx dispar n. sp.

Plate XXI. Figs. 1-2, Plate XXII. Figs. 10-12.

This species so closely resembles *A. Loveni*, M. & Tr., that no close description is needed; we need only to note the differences.

The essential feature is that the arms are unequally developed, usually two being distinctly narrower and shorter than the other three. In a specimen of 17 mm. diameter of disk, the longest arm is about 300 mm.; the two shortest, about 150 and 200 mm. The large arms are considerably broader on the middle part than at the base. In younger specimens the arms are more alike. They are not so high as in *A. Loveni*, and have a more ringed aspect, the skin being so delicate that the arm-bones are plainly seen through it. The side arm-plates are rather prominent, more than in *A. Loveni*.

There are 6–7 hook-like arm-spines, the lowermost being prolonged in the middle part of the arm, clad with skin, and with spines at the end, as in *A. Loveni*. These elongated spines are found only in large specimens, of about 20 mm. diameter of disk, and only in the broad part of the large arms.

Several specimens from Stations 3354, 322 f.; 3392, 1270 f.; 3393, 1020 f.; 3398, 1573 f.; 3402, 421 f.; 3407, 885 f.; and 3431, 995 f.

63. Asteronyx excavata n. sp.

Plate XXII. Figs. 2-6.

Diameter of disk, 18 mm.; width of arms close to disk, 3 mm.; arms of different length; in the described specimen the shortest is about 110 mm., the longest at least 200 mm. The longest arms are also larger than the shorter, and they are broadest in the middle part, as in *A. dispar*.

Mouth region as in *A. Loveni*, the mouth papillæ only being somewhat more obscured by the skin. The arms have a rather curious aspect: the side arm-plates are narrow, elongated, directed downwards, enclosed in and connected by a naked skin; they make thus a fence along each side of the arm, whose under side therefore appears deeply excavated. In side aspect

the arm appears very high, but it is really rather low; its under side is flat. On the tip of the side arm-plates there are three spines, the upper (outer) one very short, the next somewhat longer, the lowest elongated and club-shaped, enclosed in thick skin and with hooks at the end, which are also hidden in the skin; it is directed towards the under side of the arm, that is to say upwards, because of the elongated side arm-plates. On the inner part of the arm this spine lies flat on the under side, the side arm-plates not being prolonged until farther out on the arm. This feature is seen in all the arms. The two short spines are not transformed into hooks. The arm-bones are distinctly seen through the naked skin.

The radial shields are broad, covering almost the whole dorsal side of the disk, not forming ribs, as in *A. Loveni* and *dispar*. Finally the genital slits are large, much longer than in the two named species, reaching half way to the margin of the disk.

Color in alcohol: gray.

A young specimen of 5 mm. has the side arm-plates not yet very elongated, but the genital slits are already very large.

Stations 3424, 676 f., and 3426, 146 f.

64. **Asteronyx plana** n. sp.

Plate XXI. Figs. 3-4, Plate XXII. Figs. 7-9.

Diameter of disk, 10 mm.; width of arms close to disk, 2 mm.; length of arms, 10–11 times the diameter of the disk; they are about equally long and wide. Mouth papillæ obscured by the skin, not conical; only one conical papilla at the apex, and one row of teeth. (In young *A. Loveni* there is also only one row of teeth, so that there cannot be any generic value in this feature.) The side mouth shields are not elevated, there being thus no elevated wall inside the genital slits; the whole under side is quite flat.

The arms are rather flat, not looking excavated, the side arm-plates not being elongated. There are three well developed arm-spines, the two upper (outer) ones as long as $\frac{1}{2}$–$\frac{2}{3}$ of an arm-joint, the lowermost (inner) as long as $1\frac{1}{2}$ joints, club-shaped, with roughened end, enclosed in skin, but not so thickly as in the other *Asteronyx* species. The shorter spines are not transformed into hooks.

Radial shields broad and flat, covering almost the whole dorsal side of the disk. Genital slits very short.

Stations 3360, 1672 f. (2 specimens); 3375, 1201 f. (1 specimen); and 3376, 1132 f. (1 specimen). With the *A. Locardi* Koehler (64) there are now known five species of *Asteronyx*. (The *A. tenuispina* Verr. was later transferred to the genus *Hemieuryale* by VERRILL himself.) These species may be thus distinguished: —

1.	The arm-spines transformed into hooks (except the lowest)	2.
	The arm-spines not transformed into hooks	4.
2.	Lowest arm-spine not elongated	*A. Locardi* Koehler.
	Lowest arm-spine elongated	3.
3.	Arms about equally long and large	*A. Loveni* M. Tr.
	Arms unequal; the lowest arm-spine prolonged only on the large arms . .	*A. dispar* Ltk. & Mrtsn.
4.	Side arm-plates elongated; genital slits long	*A. excavata* Ltk. & Mrtsn.
	Side arm-plates not elongated; genital slits very short	*A. plana* Ltk. & Mrtsn.

65. Astroschema sublæve n. sp.

Plate XXII. Figs. 13, 14.

Diameter of disk, 12 mm.; width of arm close to disk, 5 mm.; height of arm, 5 mm.; length of arms, c. 300 mm. Mouth angles and the whole under side usually perfectly smooth; a few specimens, however, have some small grains on the ventral side of the disk; 8–9 well developed, rounded teeth. Usually no mouth papillæ distinct, only some few grains at the sides of the apex. In the smaller specimens the mouth papillæ may be rather distinct.

The rather high arms are wholly naked below; the sides and the dorsal side of the arms and the dorsal side of the disk covered with round rough grains of different size, smaller on the sides, larger on the dorsal side of the arms. On the disk the ribs are closely covered with large grains, the spaces between them only sparingly beset with smaller grains. The genital slits almost as high as the side of the disk.

At the first two pores there are no tentacle scales (or arm-spines), at the third one or two, and from the fourth there are two, sometimes three. The inner one is elongated, in the middle part of the arm as long as two joints, club-shaped, enclosed in thick skin; the outer one is scarcely longer than half a joint; the end is rough, especially on the large one.

Color in alcohol: brown.

Numerous specimens from Stations 3353, 695 f.; 3406, 551 f.; 3410, 331 f.; and 3429, 919 f.

This species is closely related to *A. clavigera* Verr., from which it seems to differ only in the character of the granulation. (*A. clavigera* is "covered with small smooth granules.") These two species and *A. intectum* Lym. differ from all the other species in the under side being destitute of granulatio

66. Gorgonocephalus Diomedeæ n. sp.

Plate XXI. Fig. 5, Plate XXII. Fig. 1.

Diameter of disk, 50 mm. Distance from the outer end of the mouth slit to the first bifurcation, 21 mm., from the first to the second bifurcation, about 15 mm., but the length between the twigs begins to be rather variable from the first. The dorsal side of the disk beset with stout, acute spines, about 1–1½ mm. long, especially on the radial shields, which form high ribs. The ventral side also is beset with spines, somewhat shorter than those of the dorsal side; along the genital slit they form a rather distinct row of papillæ. The arms are faintly granulated, the finer twigs with rings of hooks, which lie more or less regularly alternately proximally or distally directed. 3–4 arm-spines (tentacle scales); none at the first pore.

One specimen from Station 3353, 695 f. It is evidently abnormal, one half of the disk (and the arms of that part) being much larger than the other; also the spines of the disk are much more developed on the large half than on the other.

List of the Ophiuridæ of the "Albatross" Expedition, arranged by Stations.

Station 3353, Lat. 7° 6′ 15″ N., Long. 80° 34′ W., 695 fathoms. Bottom temperature 3°.89 C.

Amphiura polyacantha.
Ophiacantha costata.
Astroschema sublæve.
Gorgonocephalus Diomedeæ.

Station 3354, Lat. 7° 9′ 45″ N., Long. 80° 50′ W., 322 fathoms. Bottom temperature 7°.78 C.

Ophiochiton carinatus.
Asteronyx dispar.

Station 3355, Lat. 7° 12′ 20″ N., Long. 80° 55′ W., 182 fathoms. Bottom temperature 12°.2 C.

Amphiura gymnopora.
Amphiura granulata.

Station 3356, Lat. 7° 9′ 30″ N., Long. 81° 8′ 30″ W., 546 fathoms. Bottom temperature 4°.4 C.

Ophiernus polyporus.
Ophiochiton carinatus.
Ophiacantha spinifera.

Station 3357, Lat. 6° 35′ N., Long. 81° 44′ W., 782 fathoms. Bottom temperature 3°.6 C.

Ophioglypha plana.
Ophiacantha inconspicua.

Station 3360, Lat. 6° 17′ N., Long. 82° 5′ W., 1672 fathoms. Bottom temperature 2°.4 C.

Ophiernus seminudus.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophiacantha cosmica.
Asteronyx plana.

Station 3361, Lat. 6° 10′ N., Long. 83° 6′ W., 1471 fathoms. Bottom temperature 2°.6 C.

Ophioglypha plana.
Amphiura dalea.
Ophiacantha paucispina.

Station 3362, Lat. 5° 56′ N., Long. 85° 10′ 30″ W., 1175 fathoms. Bottom temperature 2°.7 C.

Ophiozona alba.
Ophioglypha tumulosa.
Ophiomusium glabrum.
Ophiomusium Lymani.
Ophiacantha paucispina.

Station 3363, Lat. 5° 43′ N., Long. 85° 50′ W., 978 fathoms. Bottom temperature 3° C.

Ophiozona alba.
Ophiocten pacificum.
Ophiomusium glabrum.
Ophiomusium Lymani.

Station 3364, Lat. 5° 30′ N., Long. 86° 8′ 30″ W., 902 fathoms. Bottom temperature 3°.33 C.

Ophioglypha nana.
Ophiomusium Lymani.

Station 3365, Lat. 5° 31′ N., Long. 86° 31′ W., 1010 fathoms. Bottom temperature 2°.78 C.

Ophiocten pacificum.

Station 3366, Lat. 5° 30′ N., Long. 86° 45′ W., 1067 fathoms. Bottom temperature 2°.78 C.

Ophiozona alba.
Ophioglypha tumulosa.
Ophiomusium glabrum.

Station 3370, Lat. 5° 36′ 40″ N., Long. 86° 56′ 50″ W., 134 fathoms. Bottom temperature 12°.6 C.

Ophioglypha abcisa.

Station 3371, Lat. 5° 26′ 20″ N., Long. 86° 55′ W., 770 fathoms. Bottom temperature 3°.89 C.

Ophiozona alba.
Ophiocten pacificum.
Ophiomusium Lymani.

Station 3374, Lat. 2° 35′ N., Long. 83° 53′ W., 1823 fathoms. Bottom temperature 2°.4 C.

Ophioglypha plana.
Ophiomusium glabrum.
Amphiura assimilis.

Station 3375, Lat. 2° 34′ N., Long. 82° 29′ W., 1201 fathoms. Bottom temperature 2°.6 C.

Ophioglypha obtecta.
Ophioglypha tumulosa.
Ophiocten pacificum.
Asteronyx plana.

Station 3376, Lat. 3° 0′ N., Long. 82° 8′ W., 1132 fathoms. Bottom temperature 2°.3 C.

Ophioglypha tumulosa.
Ophioglypha plana.
Ophiocten pacificum.
Ophiomusium glabrum.
Ophiomusium Lymani.
Asteronyx plana.

Station 3380, Lat. 4° 3′ N., Long. 81° 31′ W., 899 fathoms. Bottom temperature 2°.9 C.

Ophiocten pacificum.
Ophiactis profundi.
Ophiactis duplicata.
Ophiacantha contigua.

Station 3381, Lat. 4° 56′ N., Long. 80° 52′ 30″ W., 1772 fathoms. Bottom temperature 2° C.

Ophioglypha tumulosa.
Ophioglypha plana.
Ophiomusium glabrum.
Ophiacantha cosmica.

Station 3382, Lat. 6° 21′ N., Long. 80° 41′ W., 1793 fathoms. Bottom temperature 2° C.

Ophiomusium glabrum.
Ophiacantha cosmica.

Station 3384, Lat. 7° 31′ 30″ N., Long. 79° 14′ W., 458 fathoms. Bottom temperature 5°.55 C.

Amphiura serpentina, forma typica.

Station 3392, Lat. 7° 5′ 30″ N., Long. 79° 40′ W., 1270 fathoms. Bottom temperature 2°.4 C.

Gymnophiura mollis.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophiocten pacificum.
Ophiomusium glabrum.
Ophiomusium Lymani.
Amphiura gymnogastra.
Amphiura Diomedeæ, var.
Asteronyx dispar.

Station 3393, Lat. 7° 15′ N., Long. 79° 36′ W., 1020 fathoms. Bottom temperature 2°.7 C.

Ophiocten pacificum.
Ophiomusium Lymani.
Amphiura serpentina, var. *b*.
Amphiura Diomedeæ.
Amphiura notacantha (?).
Ophiacantha inconspicua.
Ophiacantha spinifera.
Asteronyx dispar.

Station 3394, Lat. 7° 21′ N., Long. 79° 35′ W., 511 fathoms. Bottom temperature 5°.4 C.

Amphiura serpentina, var. *a*.
Amphiura Diomedeæ.
Ophiochiton carinatus.

Station 3397, Lat. 7° 33′ N., Long. 78° 34′ 20″ W., 85 fathoms. Bottom temperature 14° C.

Ophionereis nuda.
Ophiomyxa panamensis.

Station 3398, Lat. 1° 7′ N., Long. 80° 21′ W., 1573 fathoms. Bottom temperature 2°.22 C.

Ophiernus seminudus.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophiocten pacificum.
Amphiura Diomedeæ.
Ophiacantha pacifica.
Asteronyx dispar.

Station 3399, Lat. 1° 7′ N., Long. 81° 4′ W., 1740 fathoms. Bottom temperature 2°.22 C.

Ophiernus seminudus.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophiomusium glabrum.
Amphiura brevipes.

Station 3400, Lat. 0° 36′ S., Long. 86° 46′ W., 1322 fathoms. Bottom temperature 2°.22 C.

Ophiozona contigua.
Ophiozona alba.
Ophiernus seminudus.
Gymnophiura mollis.
Ophioglypha obtecta.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophioglypha divisa (young).
Ophiocten pacificum.
Ophiomusium glabrum.

Station 3402, Lat. 0° 57′ 30″ S., Long. 89° 3′ 30″ W., 421 fathoms. Bottom temperature 5°.7 C.

Ophiernus annectens.
Amphiura serpentina, var. *c*.
Asteronyx dispar.

Station 3404, Lat. 1° 3′ S., Long. 89° 28′ W., 385 fathoms. Bottom temperature 6°.2 C.

Ophiomusium Diomedeæ.
Amphiura papillata.
Ophiacantha inconspicua (? young).

Station 3405, Lat. 0° 57′ S., Long. 89° 38′ W., 53 fathoms. Bottom temperature 15°.55 C.

Ophionereis sp. (arm).
Ophionereis nuda.
Ophiothrix galapagensis.
Sigsbeia lineata.

Station 3406, Lat. 0° 16′ S., Long. 90° 21′ 30″ W., 551 fathoms. Bottom temperature 5°.2 C.

Ophiactis profundi.
Ophiothamnus lævis.
Astroschema sublæve.

Station 3407, Lat. 0° 4′ S., Long. 90° 24′ 30″ W., 885 fathoms. Bottom temperature 2°.9 C.

Ophiomusium Lymani.
Ophiactis duplicata.
Ophiacantha inconspicua.
Asteronyx dispar.

Station 3408, Lat. 0° 12′ 30″ N., Long. 90° 32′ 30″ W., 684 fathoms. Bottom temperature 4°.2 C.

Ophiacantha inconspicua.

Station 3410, Lat. 0° 19′ N., Long. 90° 34′ W., 331 fathoms. Bottom temperature 6°.8 C.

Astroschema sublæve.

Station 3411, Lat. 0° 54′ N., Long. 91° 9′ W., 1189 fathoms. Bottom temperature 2°.3 C.

Ophioglypha divisa.
Ophiomusium Lymani.

Station 3413, Lat. 2° 34′ N., Long. 92° 6′ W., 1360 fathoms. Bottom temperature 2°.22 C.

Ophiozona contigua.
Ophiozona alba.
Gymnophiura mollis.
Ophioglypha obtecta.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophioglypha divisa.

Station 3414, Lat. 10° 14′ N., Long. 96° 28′ W., 2232 fathoms. Bottom temperature 2° C.

Ophiernus seminudus.
Ophioglypha tumulosa.
Ophioglypha plana.
Ophiomusium glabrum.
Amphiura dalea.
Amphilepis patens.
Ophiacantha cosmica.
Ophiacantha paucispina.

Station 3417, Lat. 16° 32′ N., Long. 99° 48′ W., 493 fathoms. Bottom temperature 4°.8 C.

Ophiomusium variabile.
Ophiacantha moniliformis.

Station 3418, Lat. 16° 33′ N., Long. 99° 52′ 30″ W., 660 fathoms. Bottom temperature 3°.89 C.

Ophiernus polyporus.
Amphiura gastracantha.
Amphiura sp.

Station 3419, Lat. 16° 34′ 30″ N., Long. 100° 3′ W., 772 fathoms. Bottom temperature 3°.89 C.

Ophioglypha superba.
Amphiura serpentina, var. *a*.

Station 3424, Lat. 21° 15′ N., Long. 106° 23′ W., 676 fathoms. Bottom temperature 3°.33 C.

Ophiernus polyporus.
Amphiura serpentina, var. *a*.
Amphiura notacantha.
Ophiacantha moniliformis.
Ophiacantha costata.
Ophiomitra granifera.
Ophiomitra partita.
Asteronyx excavata.

Station 3425, Lat. 21° 19′ N., Long. 106° 24′ W., 680 fathoms. Bottom temperature 3°.89 C.

Ophiernus polyporus.
Ophioglypha scutellata.
Ophiacantha moniliformis.
Ophiacantha costata.
Ophiacantha hirta.

Station 3426, Lat. 21° 21′ N., Long. 106° 25′ W., 146 fathoms. Bottom temperature 10°.7 C.

Ophiomusium variabile.
Ophiomitra granifera.
Asteronyx excavata.

Station 3429, Lat. 22° 30′ 30″ N., Long. 107° 1′ W., 919 fathoms. Bottom temperature 2°.78 C.

Gymnophiura cœrulescens (arms only).
Amphiura Diomedeæ
Amphiura Diomedeæ, var.
Astroschema sublæve.

Station 3430, Lat. 23° 16′ N., Long. 107° 31′ W., 852 fathoms. Bottom temperature 3°.3 C.

Amphiura seminuda.
Ophiacantha hirta.

Station 3431, Lat. 23° 59′ N., Long. 108° 40′ W., 995 fathoms. Bottom temperature 2°.78 C.

Gymnophiura cœrulescens.
Ophioglypha superba.
Ophiomusium glabrum
Ophiomusium Lymani.
Ophiacantha Bairdi.
Asteronyx dispar.

Station 3432, Lat. 24° 22′ 30″ N., Long. 109° 3′ 20″ W., 1421 fathoms. Bottom perature 3°.2 C.

Ophioglypha tumulosa.
Ophiomusium Lymani.
Ophiacantha Normani.

Station 3435, Lat. 26° 48′ N., Long. 110° 45′ 20″ W., 859 fathoms. Bottom temperature 2°.9 C.

Amphiura notacantha (?).
Ophiacantha Normani.

Station 3436, Lat. 27° 34′ N., Long. 110° 53′ 40″ W., 905 fathoms. Bottom temperature 2°.9 C.

Ophiacantha Normani.

From Panama (without exact indication of locality).

Ophioderma panamensis.
Ophioderma variegata.
Ophiactis Savignyi (Acapulco).
Amphiura granulata.
Ophionereis annulata.
Ophiothrix spiculata.
Ophiomyxa panamensis.

BIBLIOGRAPHY.

List of Papers on Ophiurids published subsequently to Lyman's Monograph of 1882. In this list are not enumerated such papers as deal only with Anatomy, Histology, or Development of Ophiurids. Those with an asterisk we have not seen.

---

1. A. Agassiz. Three Cruises of the U. S. Coast and Survey Steamer "Blake." Vol. II. Bull. Mus. Comp. Zoöl., Vol. XV. 1888.
   Gives figures of several known species.
2. A. Alcock. Natural History Notes from H. M. Indian Marine Survey Steamer "Investigator." Ser. II. No. 9. An Account of the Deep-sea Collection made during the Season of 1892–93. Journal of the Asiatic Society of Bengal, Vol. LXII. 1893.
   N. sp.: *Astroschema flosculum.*
3. C. S. Aurivillius. Hafsevertebrater från nordligaste Tromsö Amt och Vestfinmarken. Bihang til K. Sv. Vetensk.-Akad. Handlingar, Bd. XI. No. 4. 1886.
   No new species or systematic remarks on known species.

*4. T. Barrois. Catalogue des Crustacés podophthalmaires et des Echinodermes recueillis à Concarneau. Lille, 1882.
   No new species.

*5. T. Barrois. Liste des Echinodermes recueillis aux Açores durant les mois d'Août et Septembre, 1887. Revue biologique du Nord de France, Bd. I. 1888.

6. F. Jeffrey Bell. Note on the Echinoderm Fauna of the Island of Ceylon, together with some Observations on Heteractinism. Annals of Nat. Hist., 5 Ser., Vol. X. 1882.
   No new species; remarks on *Ophiocoma erinaceus* and *O. scolopendrina.*
7. F. Jeffrey Bell. Report on the Echinodermata collected by Mr. F. Day in H. M. S. "Triton," off the eastern Coast of Scotland, in July, 1882. Journ. Linn. Soc. London, Vol. XVII. 1883.
   No new species or systematic remarks on known species.
8. F. Jeffrey Bell. Echinodermata, in Report on the Zoölogical Collections made in the Indo-Pacific Ocean during the Voyage of H. M. S. "Alert," 1881–82. London, 1884.
   N. g.: *Ophiopinax* (for *Pectinura stellata* Lym.), *Neoplax.* N. sp.: *Pectinura megaloplax, Ophiopeza conjungens, Ophiothrix microplax, darwini, melanogramma, Neoplax ophiodes.* Syst. remarks on *Pectinura gorgonia* Lym., *infernalis* M. Tr., *Ophiopinax stellatus* (Lym.), *Ophiocoma brevipes* Pet., *Ophiarthrum elegans* Pet., *Ophiothrix fumaria* Lym., *martensi* Lym., *rotata* Mart., *punctolimbata* Mart., *Ophiomaza cacaotica* Lym., *Euryale aspera* Lmk.

*9. F. Jeffrey Bell. Report on a Collection of Echinodermata from Australia. Proc. Linn. Soc. New South Wales (Sidney), Vol. IX. 1884.
No new species.

10. F. Jeffrey Bell. Note on the Variations of Amphiura Chiajei Forb. Ann. Nat. Hist., 5 Ser., Vol. XX. 1887.

11. F. Jeffrey Bell. Report on a Collection of Echinodermata from the Andaman Islands. Proc. Zoöl. Soc. London, 1887.
No new species or systematic remarks on known species.

12. F. Jeffrey Bell. Report on the Echinodermata collected on Christmas Island. Ibid. 1887.
No new species or systematic remarks on known species.

13. F. Jeffrey Bell. Descriptions of four new Species of Ophiurids. Proc. Zoöl. Soc. London, 1888.
N. sp.: *Pectinura Ramsayi*, *capensis*, *Ophiopeza assimilis*, *Ophioglypha amphitrites*.

14. F. Jeffrey Bell. Notice of a remarkable Ophiurid from Brazil. Ann. Nat. Hist., 6 Ser., Vol. I. 1888.
N. sp.: *Ophionephthys* (?) *sesquipedalis*.

15. F. Jeffrey Bell. Report on a Collection of Echinoderms made at Tuticorin, Madras. Proc. Zoöl. Soc. London, 1888.
N. sp.: *Pectinura intermedia*.

16. F. Jeffrey Bell. Report of a Deep-Sea Trawling Cruise off the S. W. Coast of Ireland. Ann. Nat. Hist., 6 Ser., Vol. IV. 1889.
No new species or systematic remarks on known species.

17. F. Jeffrey Bell. Some Notes on British Ophiurids. Ann. Nat. Hist., 6 Ser., Vol. VIII. 1891.
Systematic remarks on *Ophiothrix fragilis* Müll. and *O. Lütkeni* Wyv. Thoms.

18. F. Jeffrey Bell. On the Echinoderms collected by S. S. "Fingal" and "Harlequin" off the West Coast of Ireland. Scientif. Proc. Dublin Soc., New Ser., Vol. VII. 1892.
No new species or systematic remarks on known species.

19. F. Jeffrey Bell. A Contribution to the Classification of Ophiurids, with Descriptions of some new and little known forms. Proc. Zoöl. Soc. London, 1892.
N. g., n. sp.: *Ophioteresis elegans;* remarks on *Ophiomaza obscura* Ljg. and *Ophiobyrsa hystricis* Lym.

20. F. Jeffrey Bell. Catalogue of British Echinoderms. London, 1892.
No new species; descriptions of several known species.

21. F. Jeffrey Bell. On the Echinoderms collected during the Voyage of H. M. S. "Penguin" and H. M. S. "Egeria," when surveying Macclesfield Bank. Proc. Zoöl. Soc. London, 1894.
N. g., n. sp.: *Ophiocrene ænigma*. N. sp.: *Pectinura sphenisci* and *P. elegans*. Remarks on *Ophiothrix* and *Ophiopteron elegans* Ludw.

22. M. Braun. Verzeichniss der Echinodermen des Hafens von Mahon, Menorca. Sitzungsber. d. Naturf. Gesellsch. d. Univ. Dorpat, Vol. VII. 1886.
No new species or systematic remarks on known species.

23. J. Brock. Die Ophiuridenfauna des indischen Archipels. Zeitschr. f. wiss. Zool., Bd. XLVII. 1888.
N. g.: *Lütkenia*, *Ophiæthiops*, *Ophiosphæra*, *Gymnolophus* (for *Ophiothela Holdsworthii* Smith). N. sp.: *Ophiolepis irregularis*, *Ophioglypha indica*, *Ophioconis cincta*, *Ophiactis modesta*, *Amphiura ochroleuca*, *fuscoalba*, *olivacea*, *Ophiocnida alboviridis*, *Ophionereis Sophiæ*, *fusca*, *Ophiarachna clavigera*,

Ophiomastix pusilla, elegans, Ophiothrix tenera, Lütkenia cataphracta, Ophiæthiops unicolor, Ophiosphœra insignis, Ophiomyxa longipeda. Remarks on *Ophiopeza fallax* Pet., *Pectinura gorgonia* Ltk., *septemspinosa* Ltk. (var. *longispina* Brock), *Ophiocoma erinaceus* M. Tr., all the *Ophiomastix* species, many *Ophiothrix* species, *Ophiomyxa brevispina* Mart.

*24. Camerano & Lessona. Compendio della fauna italica. Torino, 1885.
No new species.

25. J. V. Carus. Prodromus Faunæ Mediterraneæ. 1884.
No new species.

26. K. W. Dalla Torre. Die Fauna von Helgoland. Zoöl. Jahrbücher, Abth. f. Syst., Suppl. H. II. 1889.
No new species or remarks on known species.

27. L. Doederlein. Echinodermen von Ceylon. Bericht über die von den Herren Dr.'es Sarasin gesammelten Asteroidea, Ophiuroidea und Echinoidea. Zool. Jahrb. Abth. f. Syst., Bd. III. 1888.
No new species; figures of *Pectinura septemspinosa* Kuhl & v. Hass, *Ophiothrix nereidina* Lmk., *Ophiocnemis marmorata* Lmk.

28. L. Doederlein. Bericht über die von Herrn Prof. Semon bei Amboina und Thursday Island gesammelten Ophiuroidea. Zoologische Forschungsreisen in Australien, Bd. V. Lief. III. (Denkschr. d. medic.-naturw. Gesellsch. zu Jena, Bd. VIII.). 1896.
N. g.: *Ophiotriton.* N. sp.: *Amphiura Brocki, Ophiocnida verticillata, Ophiotriton Semoni, Ophiothrix belli, vitrea, lorioli, Astrophyton sculptum, Euryale Ludwigi.* Remarks on *Ophiopeza conjungens* Bell, *Pectinura septemspinosa* M. Tr., *P. arenosa* Lym., *Ophioglypha sinensis* Lym. var., *Ophiochæta hirsuta* Ltk., *Ophiactis modesta* Brock, *Ophiocoma scolopendrina*, var. *erinaceus* M. Tr., *brevipes* Pet., *Ophiomastix annulosa* Lmk., *O. asperula* Ltk., *caryophyllata* Ltk., *Ophiacantha Dallasi* Dunc., *Ophiothrix Martensi* Lym., *triloba* Mart., *nereidina* Lmk., *longipeda* M. Tr., *punctolimbata* Mart., *Bedoti* Loriol, *stelligera* Lym., *striolata* Grube, *purpurea* Mart., *Ophiothela danæ* Verr., *Ophiomaza cacaotica* Lym., *Ophiomyxa brevispina* Mart.

29. P. M. Duncan: On the Ophiuridæ of the Mergui Archipelago. Journ. Linn. Soc. London, Zoölogy, Vol. XXI. 1886.
N. g.: *Ophiocampsis.* N. sp.: *Ophiolepis nodosa, Ophiophragmus affinis, difficilis, Ophiocnida sexradia, Ophiothrix Andersoni, merguiensis, variegatus, variabilis, Ophiocampsis pellicula.* Remarks on *Ophiocoma scolopendrina* M. Tr., *Ophiocnemis marmorata* M. Tr.

30. P. M. Duncan. On some Points of the Anatomy of *Ophiothrix variabilis* Dunc. and *Ophiocampsis pellicula* Dunc. Ibid., Vol. XXI. 1886.

31. H. Farquhar. Description of a New Species of Ophiuridæ. Transact. and Proc. of the New Zealand Institute, Vol. XXVI. 1893.
N. sp. *Amphiura rosea.*

32. H. Farquhar. Notes on New Zealand Echinoderms. Ibid., Vol. XXVII. 1894.
Remarks on *Ophionereis Schayeri* M. Tr., *Ophiopeza cylindrica* Hutton, *Ophiothrix cœrulea* Hutton, *Ophiomyxa australis* Ltk.

33. H. Farquhar. A Contribution to the History of New Zealand Echinoderms. Journ. Linn. Soc. London, Zoölogy, Vol. XXVI. 1897.
N. sp.: *Ophiopeza Danbyi, Amphiura pusilla.* Remarks on *Ophiopeza cylindrica* Hutton, *Pectinura maculata* Verr., *Amphiura elegans* Leach, *Ophiopteris antipodium* Smith.

34. F. Fischer. Die Echinodermen von Jan Mayen. Die internationale Polarforschung 1882–83. Die Osterreichische Polarstation Jan Mayen, Bd. III.
No new species. Remarks on *Ophiopleura borealis* Kor. Dan., *Gorgonocephalus Agassizii* (Stimps.).

35. A. Fjelstrup. De Pighudede. Zoologia danica.
Descriptions of several known species.

*36. Gadeau de Kerville. Recherches sur les Faunes marine et maritime de la Normandie. Bull. de la Soc. des Amis d. Sc. naturelles de Rouen. 1894.
No new species.

*37. W. F. Ganong. The Echinodermata of New Brunswick. Bull. of the Nat. Hist. Soc. of New Brunswick, No. VII. 1888.
No new species.

38. R. Greeff: Echinodermen, beobachtet auf einer Reise nach der Guinea-Insel São Thomé. Zoolog. Anzeiger, Bd. V. 1882.
N. sp.: *Ophioderma guineense.*

39. J. A. Grieg. Undersögelser over Dyrelivet i de vestlandske Fjorde. Bergens Museums Aarsberetn. 1888.
No new species or systematic remarks on known species.

40. J. A. Grieg. Grönlandske Ophiurider. Ibid. 1892.
No new species. Remarks on *Ophioglypha Sarsi* Ltk., *nodosa* Ltk., *Ophiocten sericeum* Forb., *Ophiopus arcticus* Ljg., *Ophiopholis aculeata* Müll., *Gorgonocephalus Agassizii* Stimps.

41. J. A. Grieg. Ophiuroidea. Norske Nordhavsexpedition, XXII. 1893.
No new species. Remarks on *Ophiopleura borealis* Dan., *Ophiacantha abyssicola* Sars, *spectabilis* Sars, *Ophiopus arcticus* Ljg., *Gorgonocephalus Malmgreni* (var. of *G. eucnemis* M. Tr.), *Agassizii* Stimps., *Asteronyx Loveni* M. Tr.

42. J. A. Grieg. Om Echinodermfaunaen i de vestlandske Fjorde. Bergens Museums Aarbog. 1894–95.
No new species or systematic remarks on known species.

43. A. Heilprinn. Contributions to the Natural History of the Bermuda Islands. Proc. of the Acad. of Nat. Sciences of Philadelphia. 1888.
No new species. Remarks on *Ophiocoma crassispina* Say, *Ophiactis Krebsii* Ltk. (from Ives).

44. J. R. Henderson. The Echinodermata of the Firth of Clyde. Proc. R. Phys. Soc. Edinburgh, Vol. IX. 1889.
No new species or systematic remarks on known species.

45. W. A. Herdman. The Biological Results of the Cruise of the Steam Yacht "Argo" round the West Coast of Ireland, 1890. Proc. Transact. Liverpool Biolog. Soc., Vol. V. 1891.
No new species or systematic remarks on known species.

46. C. K. Hoffmann. Die Echinodermen, gesammelt während der Fahrten des "Willem Barents" (1878–79). Niederl. Arch. f. Zoologie, Suppl., Bd. I. 1882.
No new species or systematic remarks on known species.

47. R. Horst. Naamlijst der tot de Nederlandsche Fauna behoorende Echinodermata. Tijdschr. d. Nederl Dierk. Vereeniging, 2 Ser., Bd. I. 1885.
No new species or remarks on known species.

48. W. E. Hoyle. Report upon the Ophiuroidea of the Färöe Channel, mainly collected by H. M. S. "Triton," in August, 1882, with some Remarks on the Distribution of the Order. Proc. Royal Soc. Edinburgh, Vol. XII. 1884.
No new species. Remarks on *Amphiura bellis* Lym. (var. n. *tritonis*), *Ophioglypha signata* Verr., *aurantiacá* Verr.

49. W. E. Hoyle. A Revised List of British Ophiuroidea. Proc. Royal Phys. Soc. Edinburgh, Vol. VIII. 1884.
No new species or systematic remarks on known species.

50. W. E. Hoyle. On the Deep-water Fauna of the Clyde Sea Area. Journ. Linnean Soc. London, Zoölogy, Vol. XX. 1890.
No new species or systematic remarks on known species.

51. I. E. Ives. Variation in Ophiura panamensis and Ophiura teres. Proc. Acad. Nat. Sci. Philadelphia. 1889.

52. I. E. Ives. On a New Genus and Two New Species of Ophiurans. Ibid. 1889.
N. g.: *Ophioncus*. N. sp.: *Ophioglypha Lockingtoni, Ophioncus granulosus.*

53. I. E. Ives. Catalogue of the Asteroidea and Ophiuroidea in the Collection of the Academy of Natural Sciences of Philadelphia. Ibid. 1889.
No new species. Remarks on *Ophioplocus Esmarki* Lym., *Ophiopholis japonica* Lym., *Ophiactis Mülleri* Ltk., *Ophiothrix rudis* Lym., *spiculata* Leconte, *dumosa* Lym.

54. I. E. Ives. Echinoderms from the Northern Coast of Yucatan and the Harbor of Vera Cruz. Ibid. 1890.
No new species or systematic remarks on known species.

55. I. E. Ives. Echinoderms and Crustaceans collected by the West Greenland Expedition of 1891. Ibid. 1891.
No new species. Remarks on *Ophioglypha robusta* Lym.

56. I. E. Ives. Echinoderms from the Bahama Islands. Ibid. 1891.
N. sp. *Amphiura Stearnsi.*

57. I. E. Ives. Echinoderms and Arthropods from Japan. Ibid. 1891.
N. sp.: *Pectinura Stearnsi.* Remarks on *Ophioplocus imbricatus* M. Tr.

58. C. Kerbert. Echinodermes de l'Escaut de l'Est (Echinodermen van de Oosterschelde). Tijdschr. Nederl. Dierk. Vereeniging. Suppl. Del. I. 1884.
No new species. Remarks on *Ophioglypha albida* Forb. and *ciliata* M. Tr.

59. R. Koehler. Recherches sur la faune marine des îles Anglo-Normandes. Bull. de la Soc. d. Sciences de Nancy, 2 Sér., Tom. VII. 1884.
No new species or systematic remarks on known species.

60. R. Koehler. Contribution à l'étude de la faune littorale des îles Anglo-Normandes. Ann. Sci. Nat. Zool., 6 Sér., Tom. XX. 1885.
No new species or systematic remarks on known species.

61. R. Koehler. Echinodermes, recueillis à la Ciotat pendant l'été 1894. Mém. de la Soc. Zoolog. de France. 1894.
No new species. Remarks on *Ophioglypha albida* Forb., *Ophiothrix fragilis* Abgd., *echinata* M. Tr.

62. R. Koehler. Notes échinologiques. Revue biologique du Nord de la France, Tom. VII. 1894–95.
N. g.: *Paramphiura* (for *Ophiocoma punctata* Forb.). Remarks on *Ophiothrix fragilis* Abgd., *echinata* M. Tr.

63. R. Koehler. Catalogue raisonné des Echinodermes recueillis par M. Korotnev aux îles de la Sonde. Mém. Soc. Zool. de France, Tom. VIII. 1895.
N. g.: *Ophiohelix.* N. sp.: *Ophioderma propinqua, Ophiohelix elegans.* Remarks on *Ophiomaza cacaotica* Lym. (var. n. *picta*).

64. R. Koehler. Resultats scientifiques de la campagne du "Caudan" dans le Golfe de Gascogne. 1895. Annales de l'Université de Lyon. 1896.
N. sp.: *Ophioglypha Thouleti, Ophiocten le Danteci, Ophiactis corallicola, Ophioscolex retectus, Ophiacantha simulans, aristata, Ophiomitra globulifera, Astronyx Locardi.* Remarks on *Ophioglypha irrorata* Lym., *Ljungmani* Lym., *minuta*

Lym., *Amphiura duplicata* Lym., *Ophiactis Balli* Thomps., *Ophiacantha spectabilis* G. O. Sars, *rosea* Lym.

65. R. Koehler. Note préliminaire sur les Ophiures recueillis pendant les campagnes de "l'Hirondelle." Mém. Soc. Zool. de France. 1896.

N. sp.: *Ophiocten longispinum, scutatum, Amphiura denticulata, longispina.*

66. R. Koehler. Note préliminaire sur les Ophiures des prémières campagnes de la "Princesse Alice." Ibid. 1896.

N. g.: *Ophiotrema.* N. sp.: *Ophiernus abyssalis, Amphiura Richardi, grandis, Ophiacantha lineata, rufescens, Ophiomitra cordifera, Ophiotrema Alberti.* Remarks on *Ophioglypha abyssorum* Lym., *irrorata* Lym., *Amphiura angularis* Lym.

67. R. Koehler. Echinodermes recueillis par "l'Investigator" dans l'Ocean-Indien. Les Ophiures de mer profonde. Ann. Sci. nat. Zool., 8 Ser., Tom. IV. 1897.

N. g.: *Ophiotypa.* N. sp.: *Ophiotypa simplex, Ophiopyrgus Alcocki, Ophiomastus tumidus, Ophioglypha inflata, paupera, sordida, involuta, Ophiomusium familiare, elegans, Ophiopyren bispinosus, Ophiolypus granulatus, Ophioceramis tenera, Ophiozona bispinosa, Ophiopeza custos, Pectinura conspicua, Ophioconis indica, Ophiactis perplexa, Lorioli, Amphiura Caulleryi, frigida, dispar, partita, Ophiochiton ambulator, modestus, Ophiacantha pentagona, vestita, gratiosa, sociabilis, composita, duplex, vorax, Ophiomitra integra, rudis, Ophiomyxa bengalensis, Ophiocreas sp., Gorgonocephalus lævigatus, cornutus.* Remarks on *Ophioglypha æqualis* Lym., *palliata* Lym., *flagellata* Lym., *undulata* Lym., *radiata* Lym., *sculptilis* Lym., *orbiculata* Lym., *imbecillis* Lym., *Ophiomusium validum* Ljg., *scalare* Lym., *Ophiernus adspersus* Lym., *Ophiocamax fasciculata* Lym., *Ophiothrix aristulata* Lym., var. n. *Investigatoris, Astronyx Loveni* M. Tr.

68. G. M. R. Levinsen. Kara-Havets Echinodermata. Dijmphna Togtets Zoologisk-botaniske Udbytte. Kjöbenhavn, 1886.

No new species. Systematic remarks on *Ophiopleura borealis* Dan., *Astrophyton eucnemis* M. Tr.

69. P. de Loriol. Echinodermes de la Baie d'Amboine (Voyage de MM. Bedot et C. Pictet dans l'Archipel Malais). Revue Suisse de Zoologie, Tom. I. 1893.

N. sp.: *Ophiopezzella Lütkeni, Ophiactis Brocki, Ophiocnida Picteti, Ophiothrix Bedoti, Picteti.* Remarks on *Pectinura septemspinosa* Ltk., *Ophiactis sexradia* Grube, *Ophiocoma scolopendrina* Ag. var., *alternans* v. Mart., *erinaceus* M. Tr., *Ophiarachna affinis* Ltk., *Ophiomastix mixta* Ltk., *Ophiothrix punctolimbata* v. Mart., *comata* M. Tr., *galateæ* Ltk., *propinqua* Lym., *Ophiomyxa brevispina* v. Mart.

70. P. de Loriol. Catalogue raisonné des Echinodermes recueillis par G. V. de Robillard à l'île Maurice. III. Ophiurides et Astrophytides. Mém. de la Soc. de phys. et de l'hist. nat. de Genève, Tom. XXXII. 1894.

N. sp.: *Ophiopezzella dubiosa, Pectinura venusta, Ophiarachna Robillardi, mauritiensis, Ophiarthrum Lymani, Ophiothrix mauritiensis, Robillardi, lepidus, fallax, picturatus, tristis, Ophiomyxa Robillardi.* Remarks on *Ophiolepis cincta* M. Tr., *annulosa* M. Tr., *Ophioplocus imbricatus* M. Tr., *Pectinura armata* Trosch., *Ophionereis dubia* M. Tr., *Ophiocoma erinaceus* M. Tr., *scolopendrina* Ag., *brevipes* Pet., *lineolata* M. Tr., *valentiæ* M. Tr., *Ophiothrix longipeda* M. Tr., *triloba* v. Mart., *trilineata* Ltk., *Ophiothela isidicola* Ltk., *Astroschema Rousseaui* Mich., *Astrophyton clavatum* Lym.

71. H. Ludwig. Verzeichniss der von Prof. E. van Beneden an der Küste von Brasilien gesammelten Echinodermen. Mémoires couronnés, publiés par l'Acad. Royale d. Sci. de Bruxelles, Tom. XLIV. 1882.

N. g. & sp.: *Ophiothrichoides Lymani.* N. sp.: *Ophiothrix Rathbuni.* Remarks on *Amphiura januarii* Lym., *Ophiothrix angulata* Ayres.

72. H. Ludwig. Echinodermen des Beeringsmeeres. Zoolog. Jahrb. Abth. f. Syst., Bd. I. 1886.

N. sp.: *Ophioglypha maculata.* Remarks on *Ophioglypha nodosa* Ltk.

73. H. Ludwig. Ophiopteron elegans, eine neue, wahrscheinlich schwimmende Ophiuridenform. Zeitschr. f. wiss. Zool., Bd. XLVII. 1888.

*74. H. Ludwig. Bemerkungen über einige Ceylonesische Echinodermen. Sitzungsber. d. niederrheinischen Gesellsch. f. Natur. u. Heilkunde. 1890.

No new species.

75. Th. Lyman. Report on the Ophiuroidea. Exploration of the Færoe Channel during the Summer of 1880, in "Knight Errant." Proc. Royal Soc. Edinburgh. 1882.

No new species or systematic remarks on known species.

76. Th. Lyman. Report on the Ophiuroidea. Reports on the Results of Dredging in the Caribbean Sea by the U. S. Coast Survey Steamer "Blake." Bull. Mus. Comp. Zoöl., Vol. X. No. 6.

N. g.: *Ophiocopa, Ophiotoma, Ophiobrachion.* N. sp.: *Pectinura tesselata, lacertosa, angulata, Ophiozona marmorea, clypeata, Ophiernus adspersus, Ophioglypha fasciculata, abyssorum, scutata, tenera, Ophiocten Pattersoni, Ophiomastus texturatus, Amphiura incisa, nereis* (3 n. sp.?), *Ophiochytra tenuis, Ophiochiton ternispinus, Ophiacantha Bairdii, Bartletti, cervicornis, lineolata, lævipellis, scolopendrica, Ophiomitra incisa, Ophiocamax fasciculata, Ophiocopa spatula, Ophiotoma coriacea, Ophiosciasma granulatum, Ophiogeron supinus, Ophiobyrsa Perrieri, serpens, hystricis, Ophiomyxa tumida, serpentaria, Ophiochondrus crassispinus, squamosus, Hemieuryale tuberculosa, Ophiobrachion uncinatus, Ophiocreas spinulosus.* Remarks on *Ophiura elaps* (?) Lym., *Ophioglypha aurantiaca* Verr., *falcifera* Lym., *variabilis* Lym., *irrorata* (?) Lym., *convexa* (?) Lym., *Ophiomusium eburneum* Lym., *Lymani* W. Th., *Ophiophyllum petilum* Lym., *Amphiura Verrilli* (?) Lym., *tomentosa* Lym., *angularis* Lym., *Ophiacantha scutata* Lym., *echinulata* Lym., *pentacrinus* Ltk., *stellata* Lym., *Ophioscolex tropicus* Lym., *glacialis* M. Tr., *Ophiocreas oedipus* (?) Lym., *Astronyx Loveni* M. Tr.

*77. T. Marchisio. Echinodermi del Golfo di Rapallo. Bull. Musei Zool. Anat. Comp. Torino, Vol. XI. 1896.

No new species.

78. E. v. Marenzeller. Echinodermen. Berichte der Commission für Erforschung des östlichen Mittelmeeres. V. Zoologische Ergebnisse. I. Wien, 1893.

No new species. Remarks on *Ophiocten abyssicolum* Forb.

79. E. v. Marenzeller. Zoologische Ergebnisse. V. Echinodermen, gesammelt 1893–94. Berichte d. Commission für Tiefseeforschungen. XVI. Denksch. d. kaiserl. Acad. d. Wissensch. Wien, Bd. LXII. 1895.

No new species. Remarks on *Ophiocten abyssicolum* Forb., *Amphilepis florifera* Forb., *Ophiothrix alopecurus* M. Tr.

80. A. F. Marion. Esquisse d'une topographie zoologique du Golfe de Marseille. Annales du Musée d'hist. nat. de Marseille, Tom. I. 1883.

No new species or systematic remarks on known species.

81. A. F. Marion. Considérations sur les faunes profóndes de la Mediterranée. Ibid. 1883.

No new species or systematic remarks on known species.

82. G. Marktanner-Turneretscher. Beschreibung neuer Ophiuriden und Bemerkungen zu bekannten. Annalen d. k. k. naturhist. Hofmuseums Wien, Bd. III. 1887.

N. g.: *Ophiolophus.* N. sp.: *Ophiactis Ljungmani, macrolepidota, Lütkeni, Amphiura Mülleri, brevispina, Ophiocoma marmorata, Ophiothrix foveolata, Ophio-*

lophus Novaræ. Remarks on *Ophiura teres* Lym., *appressa* Say, *Pectinura spinosa* Ljg., *stellata* Ljg., *Ophiolepis cincta* M. Tr., *Ophioplocus imbricatus* M. Tr., *Ophioglypha albida* Ltk., *affinis* Ltk., *Grubei* Heller, *robusta* Ayr., *nodosa* Ltk., *Ophiactis Savignyi* M. Tr., *resiliens* Lym., *nama* Lym., *Amphiura crassipes*, Ljg., *candida* Ljg., *Chiajei* Forb., *Stimpsoni* Ltk., *constricta* Lym., *glabra* Lym., *filiformis* O. F. Müll., *occidentalis* Lym., *Ophionephthys phalerata* Lym., *Ophionereis reticulata* Say, *porrecta* Lym., *Ophiocoma scolopendrina* Lmk., *brevipes* Peters, *Valenciæ* M. Tr., *Ophiothrix fragilis* M. Tr., *alopecurus* M. Tr., *angulata*, Say, *koreana* Dunc., *cæspitosa* Lym., *propinqua* Lym., *nereidina* Lmk., *galateæ* Ltk., *stelligera* Lym., *demessa* Lym., *hirsuta* M. Tr., *comata* M. Tr., *Ophiothela Danæ* Verr.

83. v. Martens. Echinodermen von Neu-Guineea. Sitzungsber. d. Gesellsch. naturf. Freunde Berlin. 1889.
No new species. Remarks on *Ophiomastix annulosa* M. Tr. (var.).

84. Meissner und Collin. Beiträge zur Fauna der südöstlichen und östlichen Nordsee. II. Echinodermen. Wissenschaftsliche Meeresuntersuchungen, herausg. von der biol. Station Helgoland. Neue Folge, Bd. I. 1894.
No new species or systematic remarks on known species.

85. J. Murdoch. Marine Invertebrates. Report on the Expedition to Point Barrow, Alaska. (Ophiurids, p. 160.) Washington, 1885.
No new species. Remarks on *Ophiopholis aculeata* Müll.

86. H. F. Nachtrieb. Preliminary Notes on the Echinoderms of Beaufort. Ann. Nat. Hist., V. Ser., Vol. XV.
No new species or systematic remarks on known species.

87. A. M. Norman. The Fauna of the greatest Abysses of all Oceans. The Fauna as far as yet known which lives in the North Atlantic Ocean at greater Depths than one thousand Fathoms. Natural History Transact. of Northumberland and Durham, Vol. VIII. 1883.
No new species or systematic remarks on known species.

88. F. G. Pearcey. Investigations on the Movements and Food of the Herring, with Additions to the Marine Fauna of Shetland Islands. Proc. R. Phys. Soc. Edinb. 1885.
No new species or systematic remarks on known species.

89. C. G. Joh. Petersen. Det videnskabelige Udbytte af Kanonbåden "Hauchs" Togter. Echinodermata. Kjöbenhavn, 1893.
No new species or systematic remarks on known species.

90. G. Pfeffer. Die Fauna der Insel Jeretik, Port Wladimir, an der Murman-Küste. Jahrbuch d. Hamburgischen wissensch. Anstalten, Bd. VII. 1889.

91. G. Pfeffer. Fische, Mollusken und Echinodermen von Spitsbergen, gesammelt von Herrn Prof. W. Kückenthal im Jahre 1886. Zool. Jahrb. Abth. f. Syst., Bd. VIII. 1895.

92. G. Pfeffer. Echinodermen von Ost-Spitsbergen, nach der Ausbeute der Herren W. Kückenthal und Dr. Alfred Walter im Jahre 1889. Ibid. 1895.

93. G. Pfeffer. Ostafrikanische Echiniden, Asteriden und Ophiuriden, gesammelt von Herrn Dr. Fr. Stuhlmann im Jahre 1888 und 1889. Mitth. Naturhist. Museums Hamburg. 13 Jahrg. 1895.
90–93. No new species or systematic remarks on known species.

94. E. P. Ramsay. Specimens obtained on a Dredging Trip in Port Jackson. Records of the Australian Museum, Vol. I. 1890–91.
No new species or systematic remarks on known species.

*95. E. P. Ramsay. Catalogue of the Echinodermata in the Australian Museum. 2d ed., 1891.
No new species.

96. H. N. Ridley. Notes on the Zoölogy of Fernando Noronha. Journ. Linn. Soc., Vol. XX. 1890.
No new species or systematic remarks on known species.

97. A. T. de Rochebrune. Matériaux pour la faune du Cap Vert. Nouvelles Arch. du Mus. d'hist. nat. Paris, 2 Sér., Tom. IV. 1884.
No new species or systematic remarks on known species.

*98. I. M. Ruijs. Zoologische Bijdragen tot de Kennis der Karazee. I. Bijdragen tot de Dierkunde. 13 Afl. 1888.
No new species.

*99. A. Russo. Echinodermi raccolti nel Mar Rosso degli Ufficiali della R. marina Italiana. Bolletino della Soc. di Naturalisti in Napoli. 1894.
No new species.

100. A. Russo. Specie di Echinodermi poco conosciuti e nuovi viventi nel Golfo di Napoli. Atti della R. Acad. d. sc. fis. e matem. Napoli, 2 Ser., Vol. VI. 1894.
No new species. Remarks on *Ophiothrix fragilis* Abgd., *lusitanica* Ljg., *echinata* M. Tr.

*101. T. Scott. Note on Some Scottish Echinodermata. Annals of Scottish Natural History. 1892.
No new species.

102. H. Simroth. Zur Kenntniss der Azorenfauna. Arch. f. Naturgesch., Bd. I. 1888.
No new species or systematic remarks on known species.

103. W. P. Sladen. Report on a Collection of Echinodermata from the Southwest Coast of Ireland. Proc. Royal Irish Acad., 3 Ser., Vol. I. 1890.
No new species or systematic remarks on known species.

*104. W. A. Smith. Notes on Asteronyx Loveni. Annals of Scottish Natural History. 1893.

105. M. Stossich. Prospetto della fauna del mare Adriatico. Part V. Echinodermata. Bolletino della Societa Adriatica di scienze naturali (Triest), Vol. VIII. 1884.
No new species or systematic remarks on known species.

106. Th. Studer. Uebersicht über die Ophiuriden, welche während der Reise S. M. S. "Gazelle" um die Erde 1874–76 gesammelt wurden. Abhandl. d. kgl. Preussischen Akad. d. Wissensch. zu Berlin. 1882.
N. sp.: *Pectinura semicincta, Ophiolepis affinis, Ophiopyrgus saccharatus, Ophioglypha stellata, Amphiura modesta, congensis, Ophiochiton Lymani, Ophiothamnus gracilis, Ophiothrix Petersi, smaragdina, Ophioscolex prolifer.* Remarks on *Ophiogona lævigata* Stud., *Ophiolepis cincta* M. Tr., var. *nigra, Ophioglypha brevispina* Sm., *hexactis* Sm., *costata* Lym., *verrucosa* Stud., *carinata* Stud., *Ophiocten amitinum* Lym., *Ophiactis incisa* v. Mart., *cuspidata* Lym., *flexuosa* Lym., *asperula* Ltk., *Ophiocnida pilosa* Lym., *Ophionereis porrecta* Lym., *Ophiocoma tenuispina* v. Mart., *Ophiomastix flaccida* Lym., *Ophiacantha vivipara* Ljg., *Ophiothamnus remotus* Lym., *Ophiomyxa brevispina* v. Mart., *flaccida* Ltk., *vivipara* Stud.

107. Th. Studer. Verzeichniss der während der Reise S. M. S. "Gazelle" um die Erde 1874–76 gesammelten Asteriden und Euryaliden. Ibid. 1884.
N. g. & sp.: *Ophiuropsis Lymani.* N. sp.: *Ophiocreas adhærens.* Remarks on *Euryale aspera* Lmk., *Gorgonocephalus Pourtalesii* Lym.

108. Th. Studer. Die Seesterne Süd-Georgiens nach der Ausbeute des deutschen Polarstation in 1882–83. Jahrb. d. Hamburg wiss. Anstalten, Bd. II. 1885.
N. sp.: *Ophioceramis antarctica, Ophioglypha Martensi, Amphiura affinis, Lymani.* Remarks on *Ophioglypha hexactis* Sm.

109. A. Stuxberg. Evertebrat faunan i Sibiriens Ishaf. Nordenskjöld: Vega-Expeditionens Vetenskapliga Iakttagelser, Bd. I.
No new species. Remarks on *Ophioglypha Sarsi* Ltk., var. n. *arctica*.

110. I. C. Sumner. On the Echinoderm Fauna of Plymouth. Royal British Assoc. for Adv. of Sc. 1895.
No new species or systematic remarks on known species.

111. A. E. Verrill. Notice of the Remarkable Marine Fauna occupying the Outer Banks off the Southern Coast of New England. No. 3. Amer. Journ. of Science, 3 Ser., Vol. XXIII. 1882.
N. sp.: *Ophioglypha aurantiaca, Amphiura macilenta.* Remarks on *Ophioglypha confragosa* Lym. (var.).

112. A. E. Verrill. Notice, etc. No. 4. Ibid., Vol. XXIII. 1882.
N. sp.: *Ophioglypha signata.* Remarks on *Ophioglypha Sarsi* Ltk. (var.).

113. A. E. Verrill. Notice, etc. No. 6 (Restoration of Disk in Ophiurans). Ibid., Vol. XXIII. 1882.
No new species or systematic remarks on known species.

114. A. E. Verrill. Notice, etc. No. 7. Ibid., Vol. XXIV. 1882.
No new species or systematic remarks on known species.

115. A. E. Verrill. Notice, etc. No. 9. Ibid., Vol. XXVIII. 1884.
N. sp.: *Astronyx tenuispina* (later, (117) transferred to *Hemieuryale*).

116. A. E. Verrill. Notice, etc. No. 10. Ibid., Vol. XXVIII. 1884.
N. sp.: *Ophiochiton grandis.* Remarks on *Ophioglypha lepida* Lym. (var. n. *spinulosa*).

117. A. E. Verrill. Notice, etc. No. 11. Ibid., Vol. XXIX. 1885.
N. sp.: *Ophiacantha crassidens, enopla, granulifera, aculeata, Ophiomitra spinea.*

118. A. E. Verrill. Results of the Explorations made by the Steamer "Albatross" off the Northern Coast of the United States in 1883. Annual Report of the Commissioner of Fish and Fisheries for 1883. Washington, 1885.
N. sp.: *Ophiacantha fraterna, varispina, gracilis, Amphiura fragilis.* Remarks on *Ophioglypha bullata* W. Th., *lepida* Lym., var. *spinulosa* Verr., *Ljungmani* Lym., *Ophiomitra spinea* Verr., *Ophiacantha bidentata* Ljg., *granulifera* Verr., *enopla* Verr., *aculeata* Verr., *anomala* G. O. Sars, *spectabilis* G. O. Sars, *crassidens* Verr., *Ophiolebes Acanellæ* Verr., *Amphiura Otteri* Ljg., *Ophioscolex quadrispinus* Verr., *Hemieuryale tenuispina* Verr.

119. A. E. Verrill. Descriptions of New Species of Starfishes and Ophiurans, with a Revision of certain Species formerly described. Proc. U. S. National Museum, Vol. XVII. 1894.
N. sp.: *Ophioglypha saurura, tesselata, grandis, Astroschema clavigera.* Remarks on *Ophioglypha bullata* W. Th.

120. A. Walter. Ceylons Echinodermen. Jenaische Zeitschr. f. Naturw., Bd. XVIII. 1885.
No new species. Remarks on *Ophiocoma scolopendrina* Ag., *lineolata* M. Tr., *brevipes* Pet., *Ophiothrix punctolimbata* v. Mart.

*121. I. F. Whiteeaves. On some Marine Invertebrata dredged or otherwise collected by Dr. G. M. Dawson in 1885 (from British Columbia). Proc. Transact. Royal Soc. Canada, Vol. IV. 1887.
No new species.

*122. I. F. Whiteeaves. Notes on some Marine Invertebrata from the Coast of British Columbia. The Ottawa Naturalist, Vol. VII. 1893.
No new species.

123. Th. Whitelegge. List of the Marine and Fresh-water Invertebrate Fauna of Port Jackson and the Neighborhood. Journ. Proc. Royal Soc. N. S. Wales, Vol. XXIII. 1889.

No new species or systematic remarks on known species.

124. Th. Whitelegge. The Echinodermata of Funafuti. Mem. Australian Museum, Vol. III. 1897.

No new species or systematic remarks on known species.

†125. James A. Grieg. Om Bukkenfjordens Echinodermer og Mollusker. Stavanger Museums Aarsberetning for 1896.

No new species or systematic remarks on known species.

126. James A. Grieg. Skrabninger i Vaagsfjorden og Ulvesund, ytre Nordfjord. Bergens Museums Aarbog, 1897. No. XVI.

No new species. Remarks on *Amphiura elegans* Leach.

127. R. Koehler. Echinides et Ophiures provenant des campagnes du yacht l'Hirondelle. Resultats des campagnes scientifiques accomplies sur son yacht par Albert I^er^, Prince souveraine de Monaco. Fasc. XII. 1898.

N. sp.: *Ophioglypha aspera, Ophiactis echinata, Ophiacantha brevispina.* N. var.: *Ophiacantha pentagona* Koehler, var. *armata.* Remarks on *Ophioglypha carnea* Ltk., *tesselata* Verr., *Ophiocten hastatum* Lym., *scutatum* Koehler, *Ophiactis abyssicola* Sars, *Amphiura duplicata* Lym., *denticulata* Koehler, *longispina* Koehler, *tenuispina* Ljg., *Ophiacantha setosa* M. Tr.

†128. R. Koehler. Echinodermes recueillis par l'Investigator dans l'ocean Indien. Deuxième mémoire. Les Ophiures littorales. Bull. scientif. de la France et de la Belgique, Tom. XXXI. 1898.

N. g.: *Sthenocephalus.* N. sp.: *Ophiolepis rugosa, Amphiura relicta, Ophiopsila pantherina, Ophiocoma lubrica, Ophiacantha decora, vagans, Ophiomaza mœrens, Ophiothrix insidiosa, speciosa, otiosa, diligens, Stenocephalus indicus.* N. var.: *Ophiothela Danæ* Verr., var. *involuta, Ophiomyxa brevispina* Martens, var. *irregularis.* Remarks on *Pectinura arenosa* Lym., *Ophioglypha* de Loriol, *sinensis* Lym., *stellata* Studer, *Forbesi* Duncan, *Ophiocnida Picteti, echinata* Ljg., *Amphiura Duncani* Lym., *Ophiactis affinis* Dunc., *sexradia* Grube, *Ophionereis porrecta* Lym., *Ophiostigma formosa* Ltk., *Ophiocoma scolopendrina* Agass., *erinaceus* M. Tr., *Ophiomaza cacaotica* Lym., *Ophiocampsis pellucida* Dunc., *Ophiopteron elegans* Ludw., *Ophiothrix trilineata* Ltk., *striolata*, Grube, *hirsuta* M. Tr., *triloba* Martens, *propinqua* Lym., *vitrea* Doederlein, *lepidus* de Loriol, *comata* M. Tr., *Ophiarthrum elegans* Peters.

† The papers No. 125–128 we have only seen since the list was written.

Since the appearance of Lyman's Monograph in the "Challenger" Reports (Vol. V.), no less than 23 new genera and 234 (233) new species have been described. The genera are the following: —

Ophiopinax Bell (8), for *Pectinura stellata* Lym.
Neoplax Bell (8).
Ophioteresis Bell (19).
Ophiocrene Bell (21).
Lütkenia Brock (23).
Ophiœthiops " "
Ophiosphœra " "
Ophiotriton Doederlein (28).
Ophiocampsis Duncan (29).
Ophioncus Ives (52).
Paramphiura Koehler (62), for *Ophiocoma punctata* Forbes.
Ophiohelix Koehler (63).
Ophiotrema Koehler (66).
Ophiotypa Koehler (67).
Ophiothrichoides Ludwig (71).
Gymnolophus Brock (23), for *Ophiothela Holdsworthii* Smith.
Ophiopteron Ludwig (73).
Ophiocopa Lyman (76).
Ophiotoma " "
Ophiobrachion " "
Ophiolophus Marktauner-Turneretscher (82).
Ophiuropsis Studer (107)
Sthenocephalus Koehler (128).

Of the new species more than half the number comes in the following six genera: *Pectinura* (13 sp.), *Ophioglypha* (21 sp.), *Ophiactis* (9 sp.), *Amphiura* (26 sp.), *Ophiothrix* (27 sp.), *Ophiacantha* (27 sp.). They are here all enumerated.

Ophioderma guineense Greeff (38).
" *propinqua* Koehler (63).
Ophioncus granulosus Ives (52).
Ophiopeza conjungens Bell (8).
" *assimilis* Bell (13).
" *Danbyi* Farquhar (33).
" *custos* Koehler (67).
Ophiopezzella Lütkeni Loriol (69).
" *dubiosa* Loriol (70).
Pectinura megaloplax Bell (8).
" *Ramsayi* Bell (13).
" *capensis* " "
" *intermedia* Bell (15).
" *sphenisci* Bell (21).
" *elegans* " "
" *Stearnsi* Ives (57).
" *conspicua* Koehler (67).
" *venusta* Loriol (70).
" *tesselata* Lyman (76).
" *lacertosa* " "
Pectinura angulata Lyman (76).
" *semicincta* Studer (106).
Ophiolepis irregularis Brock (23).
" *nodosa* Duncan (29).
" *affinis* Studer (106).
" *rugosa* Koehler (128).
Ophiozona bispinosa Koehler (67).
" *marmorea* Lyman (76).
" *clypeata* " "
Ophioceramis tenera Koehler (67).
" *antarctica* Studer (108).
Ophiernus abyssalis Koehler (66).
" *adspersus* Lyman (76).
Ophiopyrgus Alcocki Koehler (67).
" *saccharatus* Studer (106).
Ophioglypha amphitrites Bell (13).
" *indica* Brock (23).
" *Lockingtoni* Ives (52).
" *Thouleti* Koehler (64).
" *inflata* Koehler (67).

Ophioglypha paupera Koehler (67).
" *sordida* " "
" *involuta* " "
" *maculata* Ludwig (72).
" *fasciculata* Lyman (76).
" *abyssorum* " "
" *scutata* " "
" *tenera* " "
" *stellata* Studer (106).
" *Martensi* Studer (108).
" *aurantiaca* Verrill (111).
" *signata* Verrill (112).
" *saurura* Verrill (119).
" *tesselata* " "
" *grandis* " "
" *aspera* Koehler (127).
Ophiocten le Danteci Koehler (64).
" *longispinum* [= *O. hastatum* Lym. (127)] Koehler (65)
" *scutatum* " "
" *Pattersoni* Lyman (76).
Ophiomusium familiare Koehler (67).
" *elegans* " "
Ophiolipus granulatus " "
Ophiomastus tumidus " "
" *texturatus* Lyman (76).
Ophiotypa simplex Koehler (67).
Ophiopyren bispinosus Koehler (67).
Ophioconis cincta Brock (23)
" *indica* Koehler (67).
Ophiactis modesta Brock (23).
" *corallicola* Koehler (64).
" *perplexa* Koehler (67).
" *Lorioli** " "
" *Brocki* Loriol (69).
" *Ljungmani* Marktanner-Turneretscher (82)
" *macrolepidota* " "
" *Lütkeni* " "
" *echinata* Koehler (127).
Amphiura ochroleuca Brock (23).
" *fuscoalba* " "
" *olivacea* " "
" *Brocki* Doederlein (28).
" *rosea* Farquhar (31).
" *pusilla* Farquhar (33).
" *Stearnsi*† Ives (56).
" *denticulata* Koehler (65).
" *longispina* " "

Amphiura Richardi Koehler (66).
" *grandis* " "
" *Caulleryi* Koehler (67).
" *frigida* " "
" *dispar* " "
" *partita*‡ " "
" *incisa* Lyman (76).
" *nereis* " "
" *Mülleri* Marktanner-Turneretscher (82).
" *brevispina* " "
" *modesta* Studer (106).
" *congensis* " "
" *affinis* Studer (108).
" *Lymani* " "
" *macilenta* Verrill (111).
" *fragilis* Verrill (118).
" *relicta* Koehler (128).
Ophionephthys (?) *sesquipedalis* Bell (14).
Ophiocnida alboviridis Brock (23).
" *sexradia* Duncan (29).
" *verticillata* Doederlein (28).
" *Picteti* Loriol (69).
Ophiophragmus affinis Duncan (29).
" *difficilis* " "
Ophionereis Sophiæ Brock (23).
" *fusca* " "
Ophiotriton Semoni Doederlein (28).
Ophiopsila pantherina Koehler (128).
Ophiochytra tenuis Lyman (76).
Ophiocoma marmorata Marktanner-Turneretscher (82).
" *lubrica* Koehler (128).
Ophiarachna clavigera Brock (123).
" *Robillardi* Loriol (70).
" *mauritiensis* " "
Ophiarthrum Lymani Loriol (70).
Ophiomastix pusilla Brock (23).
" *elegans* " "
Ophiochiton ambulator Koehler (67).
" *modestus* " "
" *tenuispinus* Lyman (76).
" *Lymani* Studer (106).
" *grandis* Verrill (116).
Ophiacantha simulans Koehler (64).
" *aristata* " "
" *lineata* Koehler (66).
" *rufescens* " "
" *pentagona* Koehler (67).

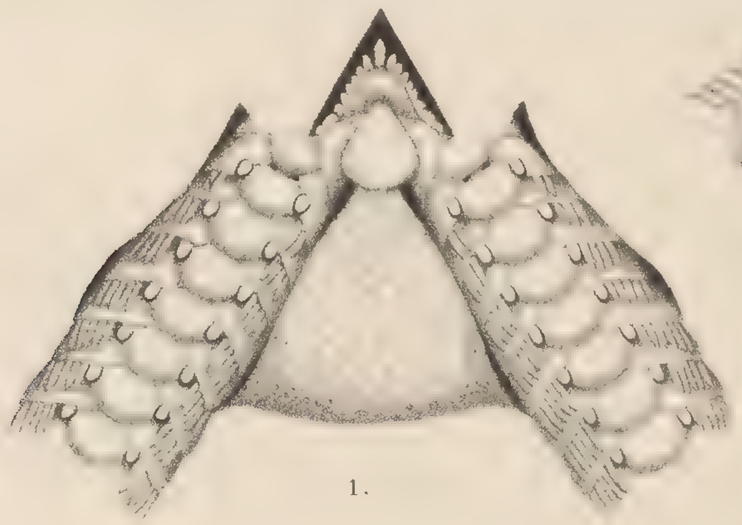
* Evidently an *Amphiura*. † Evidently an *Ophionereis*. ‡ Evidently an *Ophiactis*.

Ophiacantha vestita Koehler (67).
" *gratiosa* " "
" *sociabilis* " "
" *composita* " "
" *duplex* " "
" *vorax* " "
" *Bairdii* Lyman (76).
" *Bartletti* " "
" *cervicornis* " "
" *lineolata* " "
" *lævipellis* " "
" *scolopendrica* " "
" *crassidens* Verrill (117).
" *enopla* " "
" *granulifera* " "
" *aculeata* " "
" *fraterna* Verrill (118).
" *varispina* " "
" *gracilis* " "
" *brevispina* Koehler (127).
" *decora* Koehler (128).
" *vagans* " "
Ophiomitra globulifera Koehler (64).
" *cordifera* Koehler (66).
" *integra* Koehler (67).
" *rudis* " "
" *incisa* Lyman (76).
" *spinea* Verrill (117).
Ophiocamax fasciculata Lyman (76).
Ophiothamnus gracilis Studer (106).
Ophiocopa spatula Lyman (76).
Ophiotrema Alberti Koehler (66).
Ophiothrix microplax Bell (8).
" *Darwini* "
" *melanogramma* "
" *tenera* Brock (23).
" *Belli* Doederlein (28).
" *vitrea* " "
" *Lorioli* " "
" *Andersoni* Duncan (29).
" *merguiensis* " "
" *variegatus* " "
" *variabilis* " "
" *Bedoti* Loriol (69).
" *Picteti* " "
" *mauritiensis* Loriol (70).
" *Robillardi* " "
" *lepidus* " "
" *fallax* " "
" *picturatus* " "
" *tristis* " "

Ophiothrix Rathbuni Ludwig (71).
" *foveolata* Marktanner-Turneretscher (82).
" *Petersi* Studer (106).
" *smaragdina* " "
" *insidiosa* Koehler (128),
" *speciosa* " "
" *otiosa* " "
" *diligens* " "
Ophiothrichoides Lymani Ludwig (71).
Lütkenia cataphracta Brock (23).
Ophicæthiops unicolor " "
Ophiosphæra insignis " "
Ophiocampsis pellicula Duncan (29).
Ophiopteron elegans Ludwig (73).
Ophiolophus Novaræ Marktanner-Turneretscher (82).
Ophiohelix elegans Koehler (63).
Ophiomaza moerens Koehler (128).
Ophioscolex retectus Koehler (64).
" *prolifer* Studer (106).
Ophiosciasma granulatum Lyman (76).
Ophiogeron supinus Lyman (76).
Ophiotoma coriacea Lyman (76).
Neoplax ophiodes Bell (8).
Ophioteresis elegans Bell (19).
Ophiobyrsa Perrieri Lyman (76).
" *serpens* " "
" *hystricis* " "
Ophiomyxa longipeda Brock (23).
" *bengalensis* Koehler (67).
" *Robillardi* Loriol (70).
" *tumida* Lyman (76).
" *serpentaria* " "
Ophiochondrus crassispinus Lyman (76).
" *squamosus* Lyman (76).
Hemieuryale tuberculosa Lyman (76).
" *tenuispina* Verrill (115).
Ophiuropsis Lymani Studer (107).
Ophiobrachion uncinatus Lyman (76).
Ophiocreas spinulosus Lyman (76).
" *adhærens* Studer (107).
Astroschema flosculum Alcock (2).
" *clavigera* Verrill (119).
Asteronyx Locardi Koehler (64).
Ophiocrene enigma Bell (21).
Sthenocephalus indicus Koehler (128).
Euryale Ludwigi Doederlein (28).
Astrophyton sculptum Doederlein (28).
Gorgonocephalus lævigatus Koehler (67).
" *cornutus* " "

PLATE I.

Fig. 1. *Ophioderma variegata* Ltk. Ventral side. $\frac{6}{1}$.
Fig. 2. " " Dorsal side. $\frac{6}{1}$.
Fig. 3. " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 4. *Ophioglypha superba* Ltk. & Mrtsn. Ventral side. $\frac{3}{1}$.
Fig. 5. " " " Dorsal side. $\frac{3}{1}$.
Fig. 6. " " " Margin of the disk in an interbrachial space. $\frac{3}{1}$.
Fig. 7. " " " Outer end of the genital plate, with the arm-comb. $\frac{3}{1}$.
Fig. 8. " " " Arm-joints in side view. $\frac{3}{1}$.
Fig. 9. " *tumulosa* Ltk. & Mrtsn. Ventral side. $\frac{4}{1}$.
Fig. 10. " " " Dorsal side. $\frac{4}{1}$.
Fig. 11. " " " Dorsal side of a larger specimen. $\frac{3}{1}$.
Fig. 12. " " " Ventral side of arm. $\frac{4}{1}$.
Fig. 13. " " " Arm-joints in side view. $\frac{4}{1}$.



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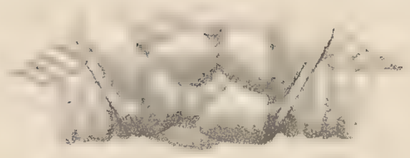

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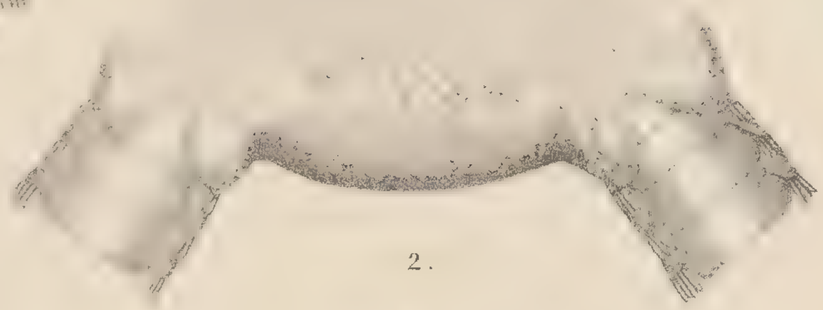

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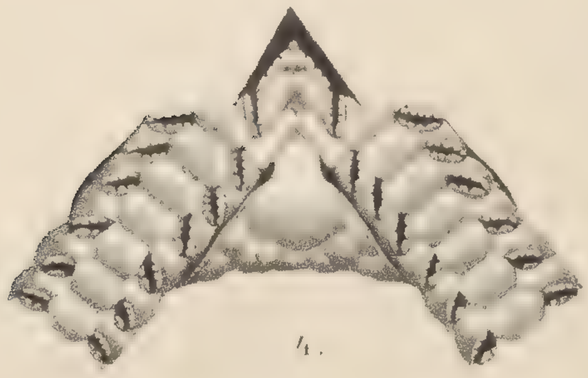

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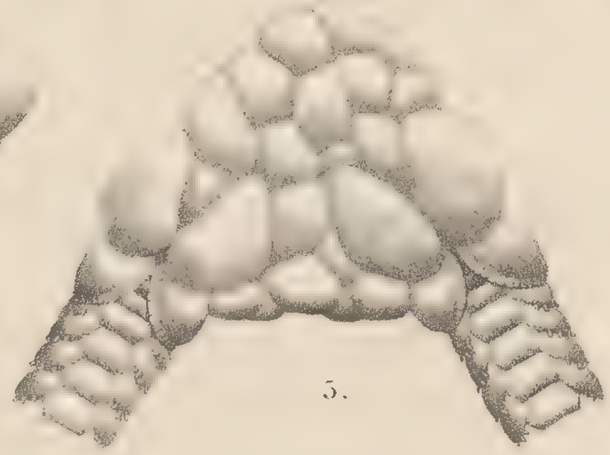

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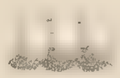

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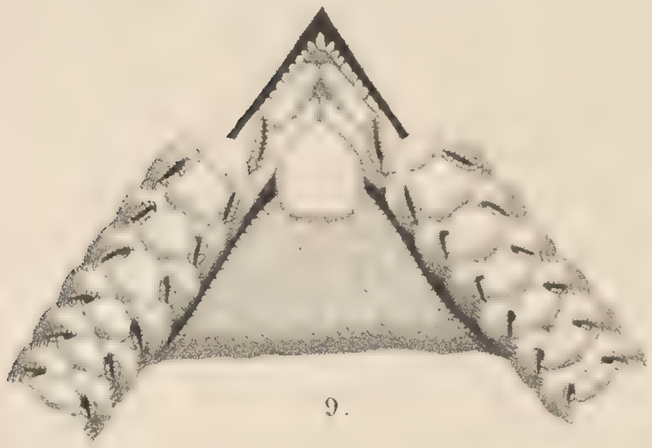

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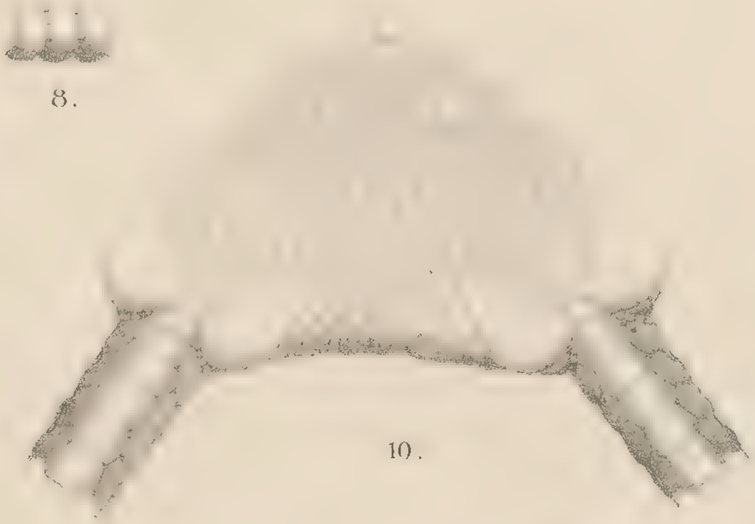

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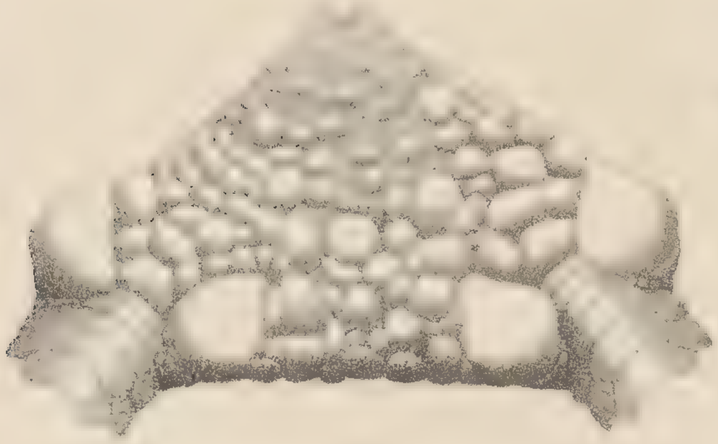

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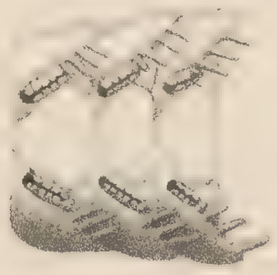
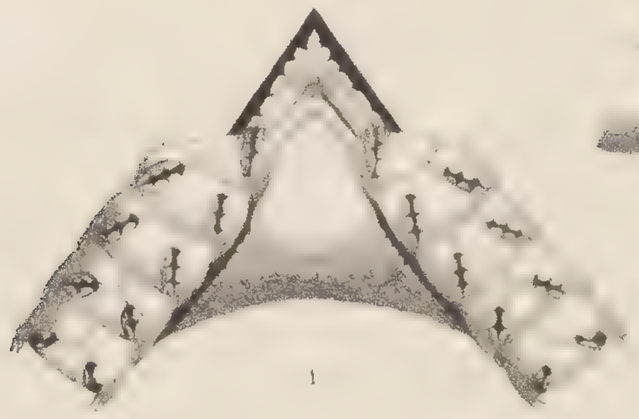


12.

1-3 Ophioderma variegata Ltk. : 4-8. Ophioglypha superba n.sp. 9-13 O tumulosa n.sp.

PLATE II.

Fig. 1. *Ophioglypha abcisa* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 2. " " " Dorsal side. $\frac{8}{1}$.
Fig. 3. " " " Arm-joints in side view. $\frac{8}{1}$.
Fig. 4. " *scutellata* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 5. " " " Dorsal side. $\frac{6}{1}$.
Fig. 6. " " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 7. " *obtecta* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 8. " " " Dorsal side. $\frac{8}{1}$.
Fig. 9. " " " Arm-joints in side view. $\frac{8}{1}$.
Fig. 10. " *nana* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 11. " " " Dorsal side. $\frac{8}{1}$.
Fig. 12. " " " Arm-joints in side view. $\frac{8}{1}$.



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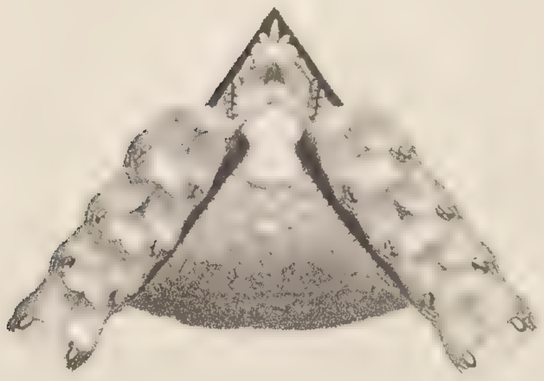

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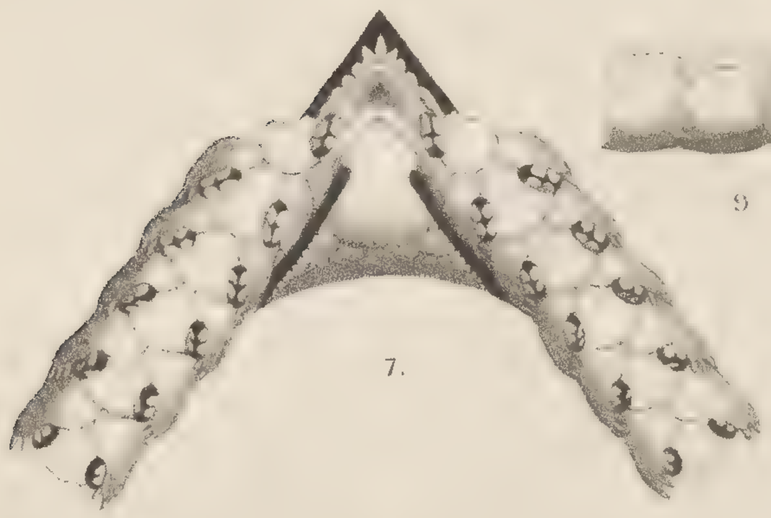

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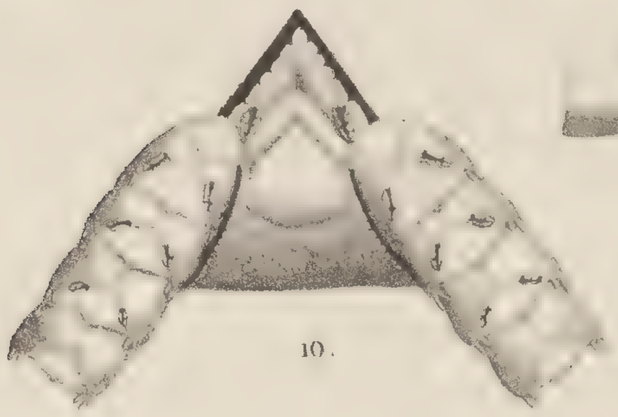

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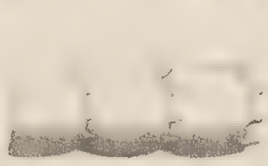

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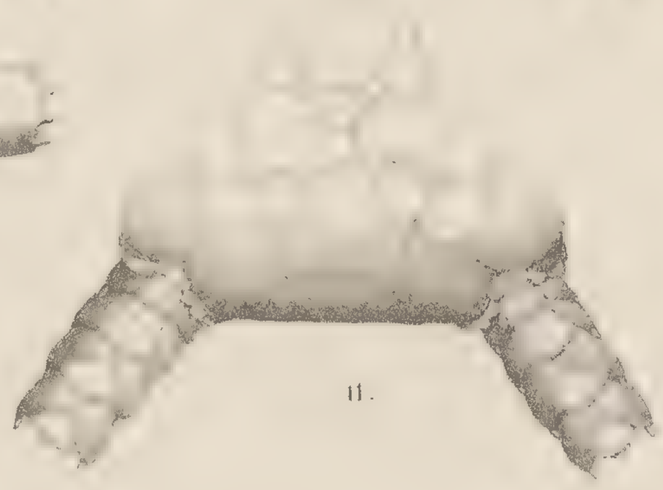
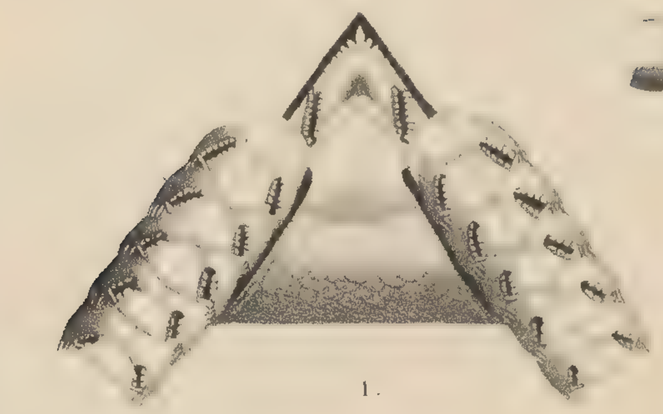


11.

1-3. Ophioglypha abcisa n.sp. 4-6. O. scutellata n.sp. 7-9. O. oblecta n.sp. 10-12. O. nana n.sp.

PLATE III.

Fig. 1. *Ophioglypha plana* Ltk. & Mrtsn. Ventral side. $\frac{5}{1}$.
Fig. 2. " " " Dorsal side. $\frac{6}{1}$.
Fig. 3. " " " Dorsal side of another specimen. $\frac{6}{1}$.
Fig. 4. " " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 5. *Ophiocten pacificum* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 6. " " " Dorsal side. $\frac{6}{1}$
Fig. 7. " " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 8. *Ophiomusium Lymani* Wyv. Thoms. Ventral side. $\frac{8}{1}$.
Fig. 9. " " " Ventral side of another specimen. $\frac{4}{1}$.
Fig. 10. " " " Dorsal side. $\frac{3}{1}$.
Fig. 11. " " " Arm-joints in side view. $\frac{8}{1}$.



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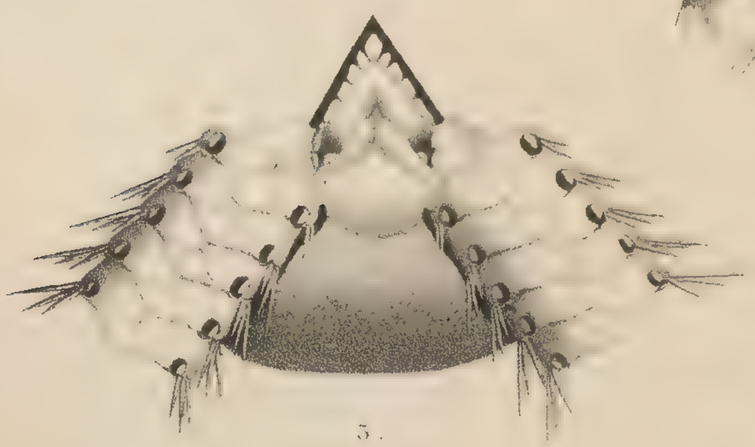

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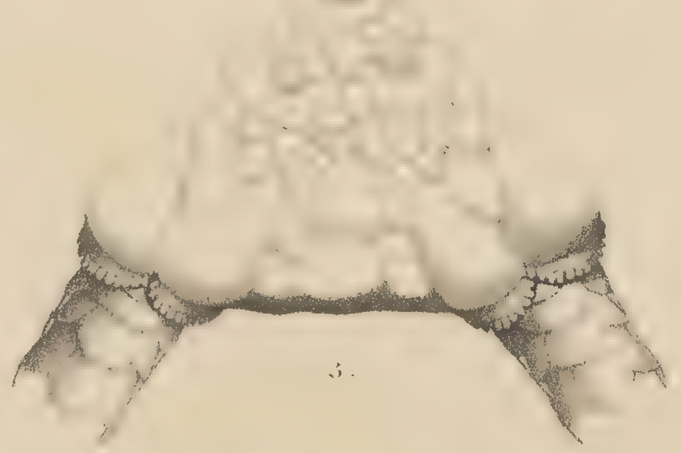

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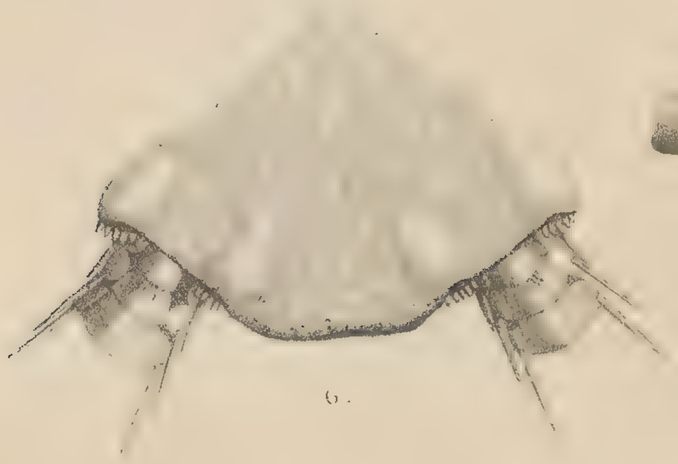

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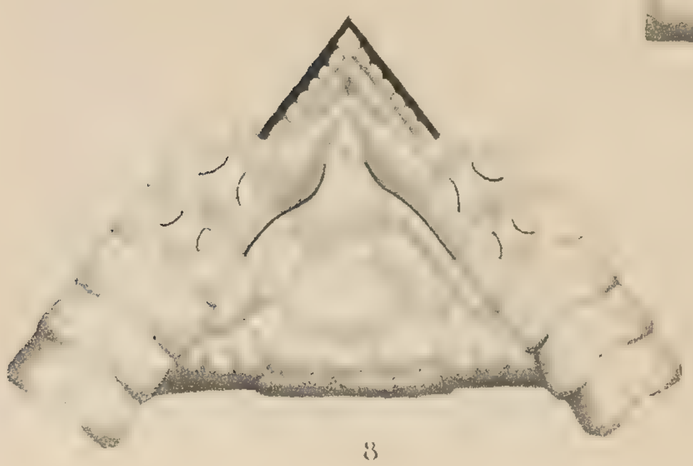

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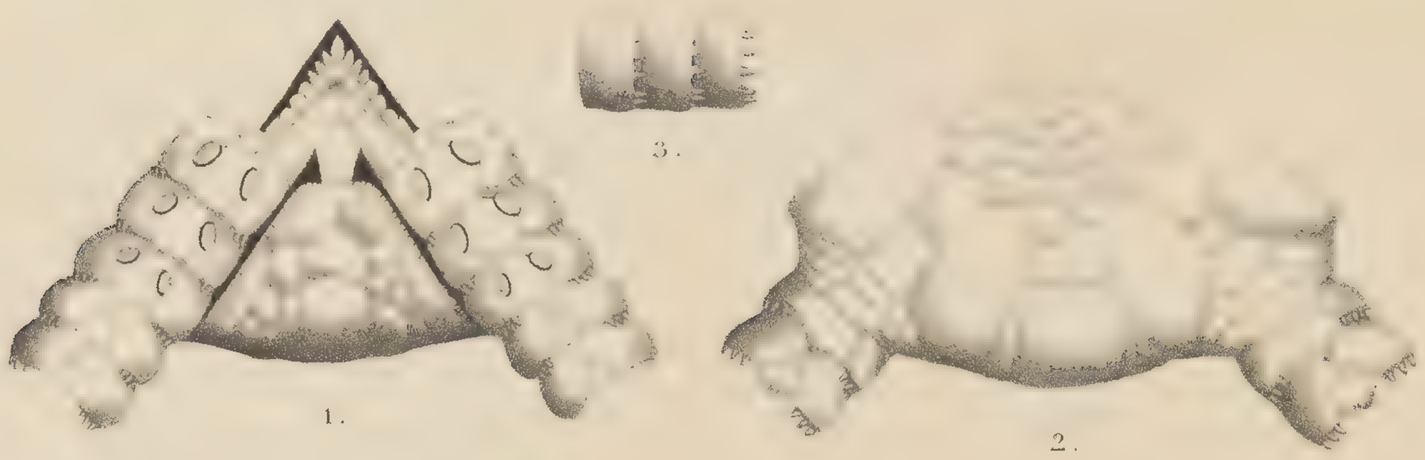
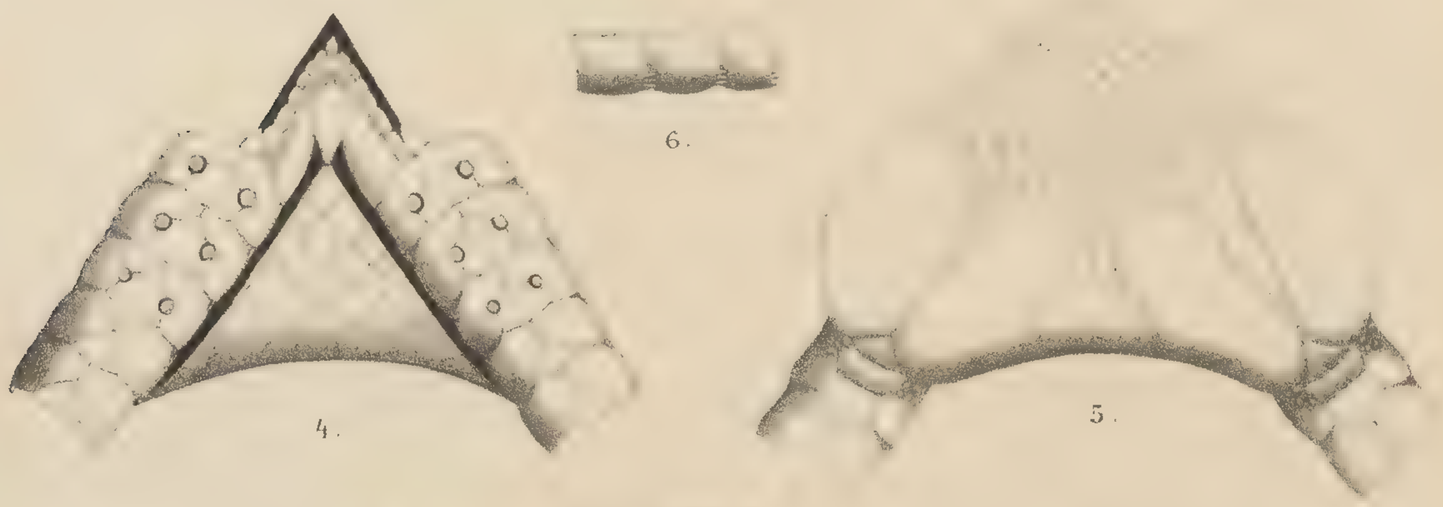
1-4 Ophioglypha plana n.sp. 5-7 Ophiocten pacificum n.sp. 8-11 Ophiomusium Lymani W. Thoms.

PLATE IV.

Fig. 1. *Ophiomusium Diomedeæ* Ltk. & Mrtsn. Ventral side. $\frac{5}{1}$.
Fig. 2. " " " Dorsal side. $\frac{5}{1}$.
Fig. 3. " " " Arm-joints in side view. $\frac{5}{1}$.
Fig. 4. " *variabile* Ltk. & Mrtsn. Ventral side. $\frac{5}{1}$.
Fig. 5. " " " Dorsal side. $\frac{5}{1}$.
Fig. 6. " " " Arm-joints in side view. $\frac{5}{1}$.
Fig. 7. " *glabrum* Ltk. & Mrtsn. Ventral side. $\frac{3}{1}$.
Fig. 8. " " " Dorsal side. $\frac{3}{1}$.
Fig. 9. " " " Arm-joints in side view. $\frac{3}{1}$.
Fig. 10. *Ophioglypha divisa* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 11. " " " Dorsal side. $\frac{6}{1}$.
Fig. 12. " " " Arm-joints in side view. $\frac{9}{1}$.

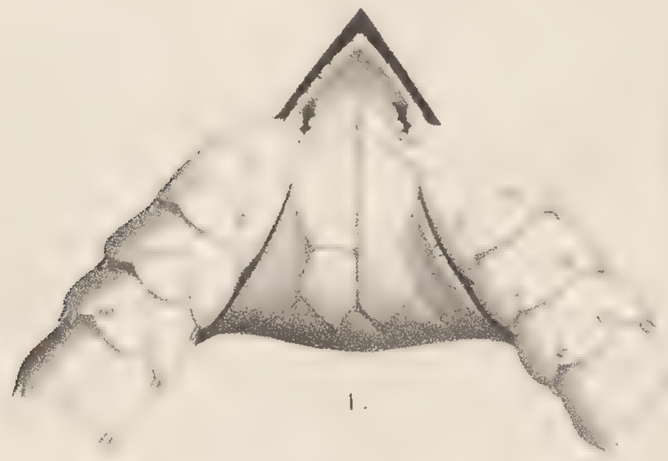




1-3 Ophiomusium diomedeæ n.sp. 4-6 O.variabile n.sp. 7-9 O.glabrum n.sp. 10-12 Ophioglypha divisa n.sp

PLATE V.

Fig. 1. *Ophioglypha divisa* Ltk. & Mrtsn Ventral side. $\frac{6}{1}$.
Fig. 2. " " " Dorsal side. Young specimen. $\frac{12}{1}$.
Fig. 3. " *abcisa* Ltk. & Mrtsn. Arm-comb; on the left side the genital scale is removed, so that the secondary arm-comb is seen. $\frac{10}{1}$.
Fig. 4. *Ophiernus annectens* Ltk. & Mrtsn. Ventral side. $\frac{5}{1}$.
Fig. 5. " " " Dorsal side. $\frac{5}{1}$.
Fig. 6. " " " Arm-joints in side view. $\frac{5}{1}$.
Fig. 7. " *polyporus* Ltk. & Mrtsn. Ventral side. $\frac{4}{1}$.
Fig. 8. " " " Dorsal side. $\frac{4}{1}$.
Fig. 9. " " " Arm-joints in side view. $\frac{4}{1}$.
Fig. 10. " *seminudus* Ltk. & Mrtsn. Ventral side. $\frac{4}{1}$.
Fig. 11. " " " Dorsal side. $\frac{4}{1}$.
Fig. 12. " " " Arm-joints in side view. $\frac{4}{1}$.



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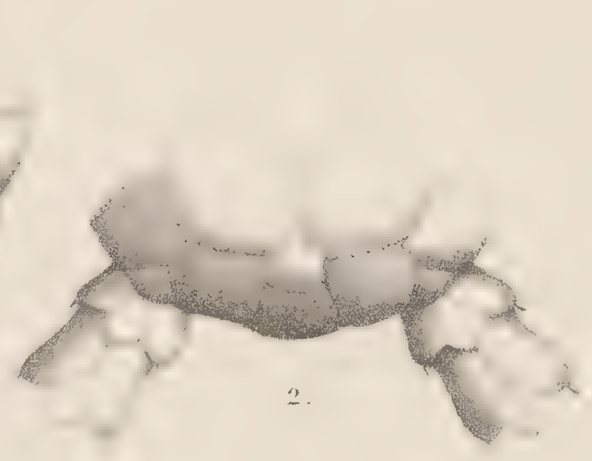

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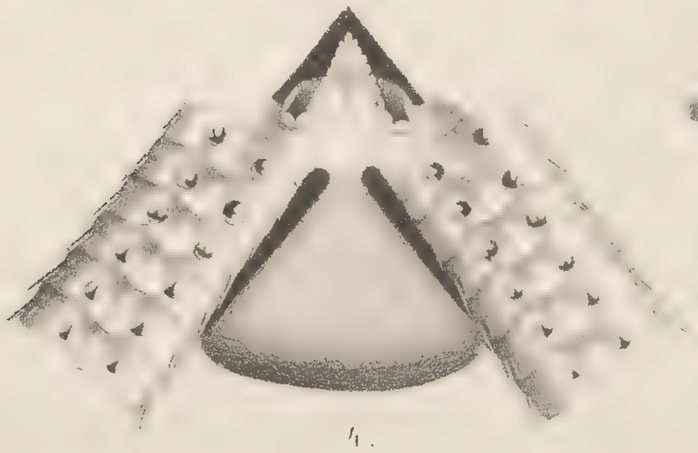

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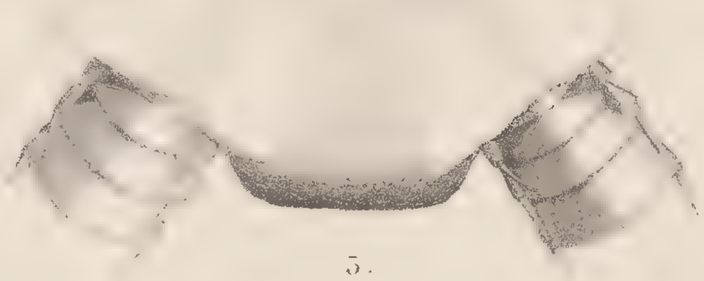

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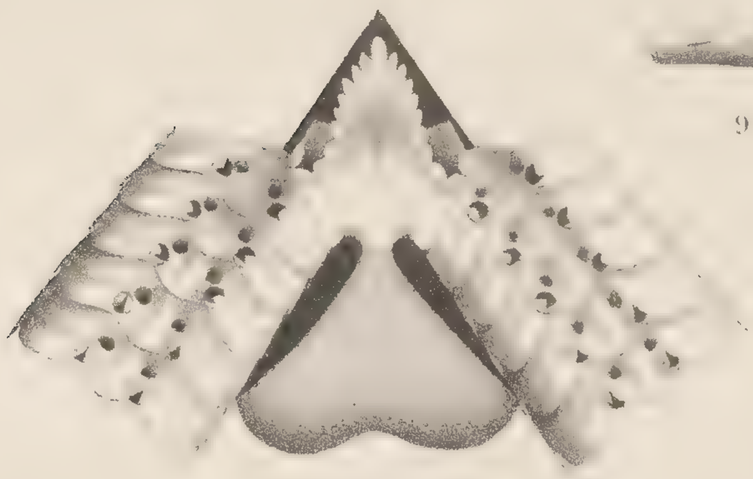

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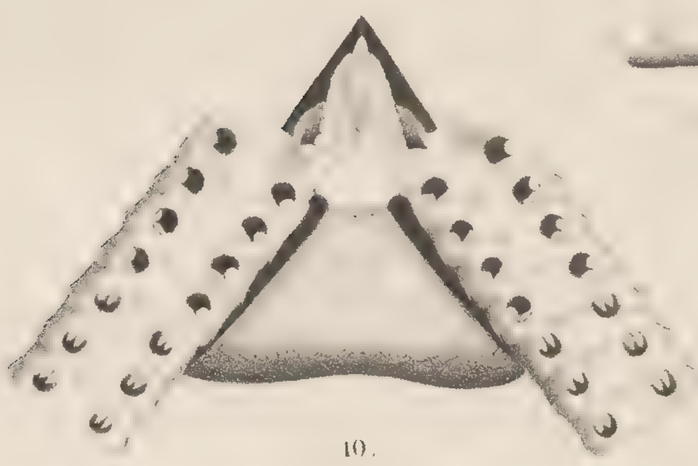

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1-2 Ophioglypha divisa n.sp. 3. O. abcisa n.sp. 4-6 Ophiernus annectens n.sp.
7-9 O. polyporus n.sp. 10-12. O. seminudus n.sp.

PLATE VI.

Fig. 1. *Ophiactis duplicata* (Lym.). Ventral side. $\frac{8}{1}$.
Fig. 2. " " " Dorsal side. $\frac{8}{1}$.
Fig. 3. " " " Arm-spines. $\frac{8}{1}$.
Fig. 4. " *profundi* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 5. " " " Dorsal side. $\frac{8}{1}$.
Fig. 6. " " " Arm-joint in side view. $\frac{8}{1}$.
Fig. 7. *Ophiozona alba* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 8. " " " Dorsal side. $\frac{6}{1}$.
Fig. 9. " " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 10. " *contigua* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 11. " " " Dorsal side. $\frac{8}{1}$.
Fig. 12. " " " Arm-joints in side view. $\frac{8}{1}$.

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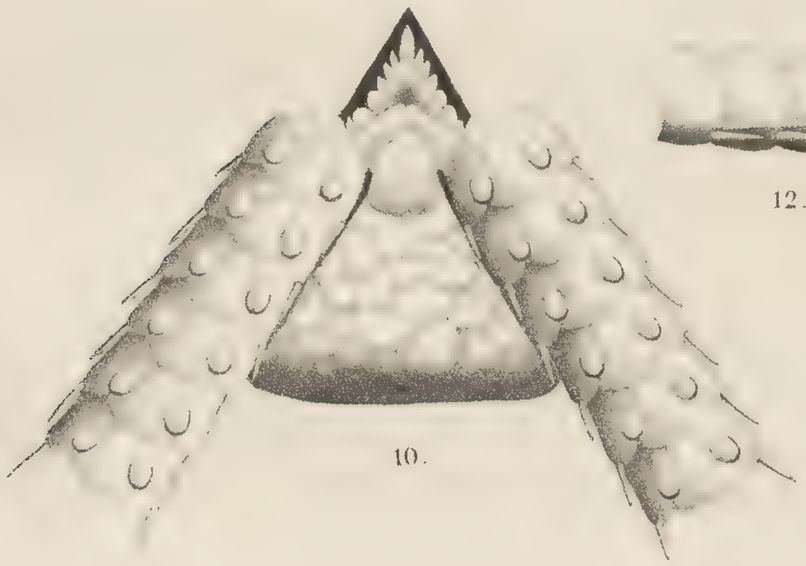

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1-3 Ophiacis duplicata (Lym.) 4-6 O.profundi n.sp. 7-9 Ophiozona alba n.sp. 10-12 O.contigua n.sp.

PLATE VII.

Fig. 1. *Ophiomyxa panamensis* Ltk. & Mrtsn. Ventral side. $\frac{5}{1}$.
Fig. 2. " " " Dorsal side. $\frac{5}{1}$.
Fig. 3. " " " Arm-spines. $\frac{5}{1}$.
Fig. 4. *Ophioglypha superba* Ltk. & Mrtsn. Side view of inner arm-joints, the genital plate removed, so that the secondary arm-comb is seen. $\frac{2}{1}$.
Fig. 5. *Gymnophiura cærulescens* Ltk. & Mrtsn. Ventral side. $\frac{3}{1}$.
Fig. 6. " " " Dorsal side. $\frac{3}{1}$.
Fig. 7. " " " Arm-joints in side view. $\frac{3}{1}$.
Fig. 8. " *mollis* Ltk. & Mrtsn. Ventral side. $\frac{3}{1}$.
Fig. 9. " " " Dorsal side. $\frac{3}{1}$.
Fig. 10. " " " Arm-joints in side view. $\frac{3}{1}$.

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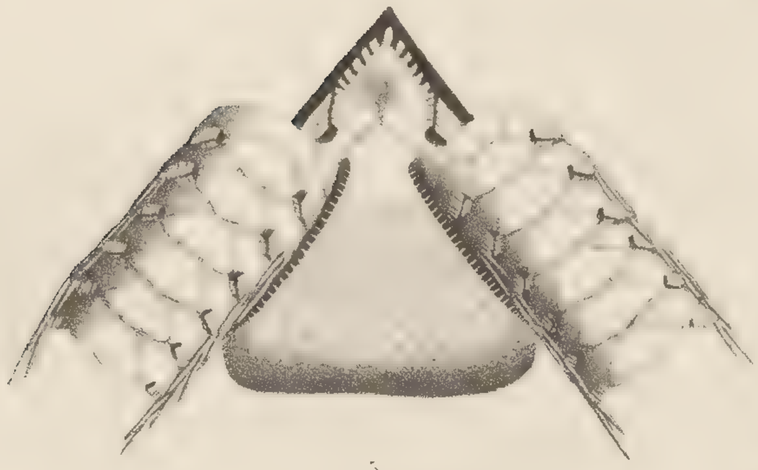

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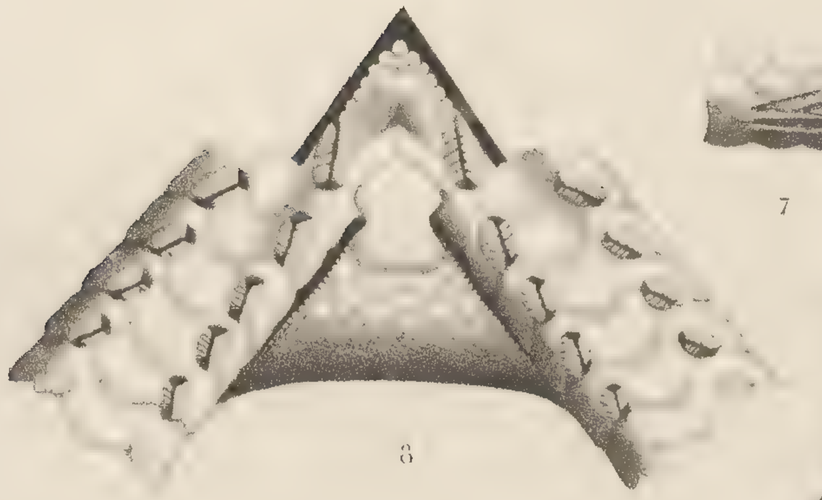

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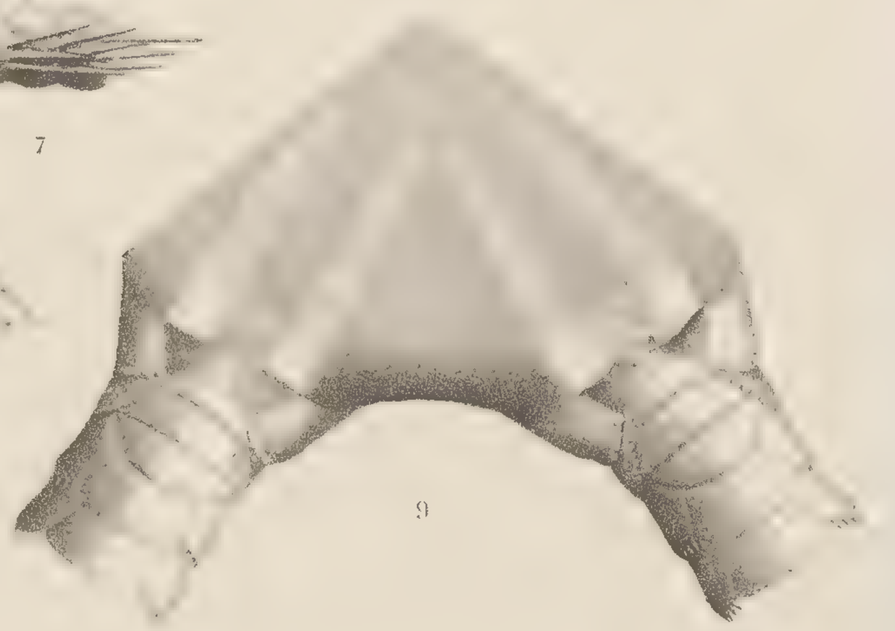

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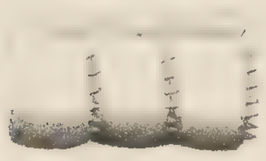

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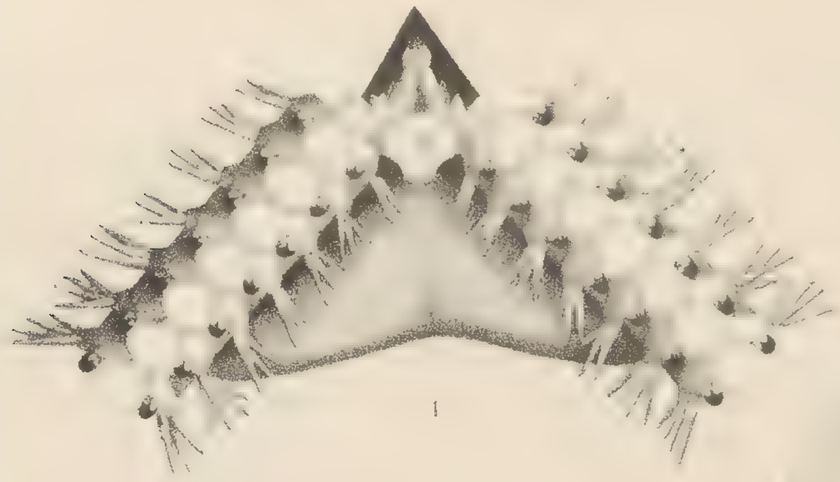
1 3 Ophiomyxa panamensis n.sp. 4 Ophioglypha superba 5-7 Gymnophiura coerulescens n.g., n.sp. 8-10 G. mollis n.sp.

PLATE VIII.

Fig. 1. *Amphiura serpentina* Ltk. & Mrtsn., forma typica. Ventral side. $\frac{8}{1}$.
Fig. 2. " " " " " Dorsal side. $\frac{8}{1}$.
Fig. 3. " " " " " Arm-spines. $\frac{8}{1}$.
Fig. 4. " " " var. *a*. Ventral side. $\frac{6}{1}$.
Fig. 5. " " " " Dorsal side. $\frac{6}{1}$.
Fig. 6. " " " var. *b*. Ventral side. $\frac{6}{1}$.
Fig. 7. " " " " Dorsal side. $\frac{6}{1}$.
Fig. 8. " " " " Arm-joint in side view. $\frac{6}{1}$.



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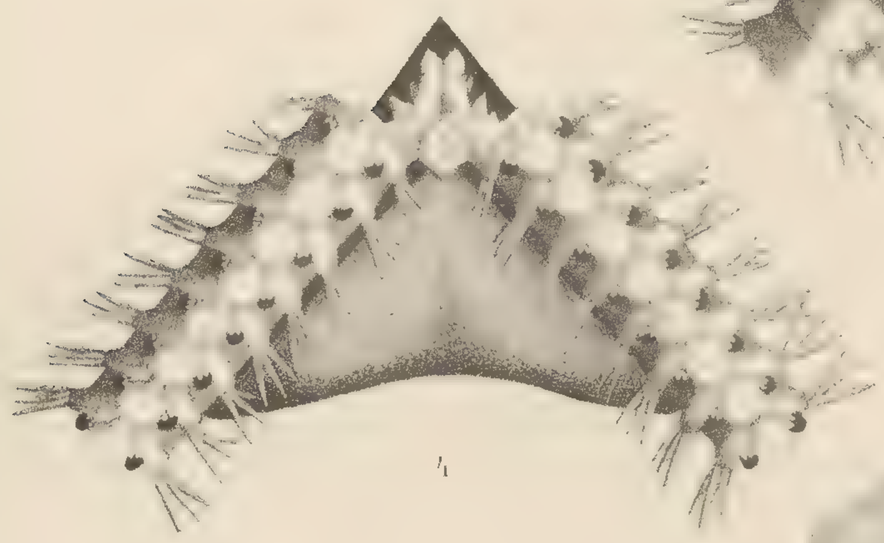

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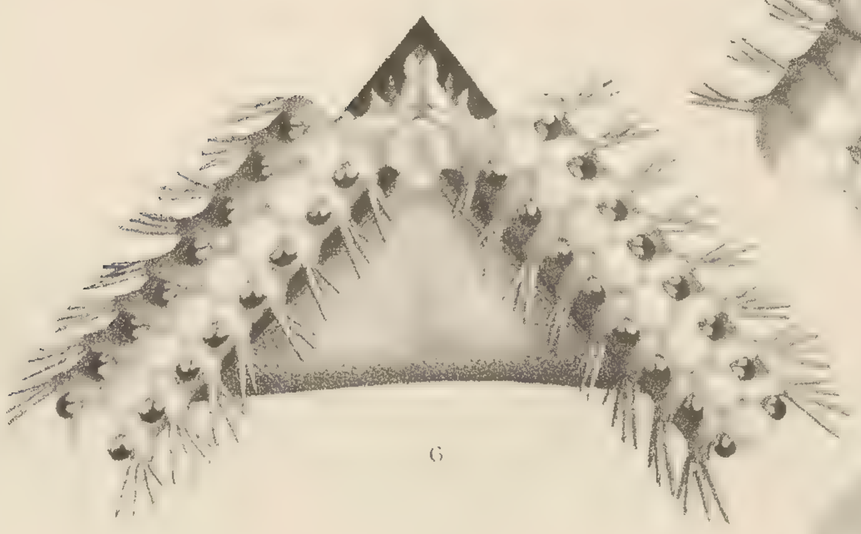

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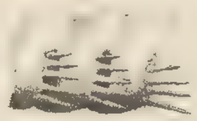

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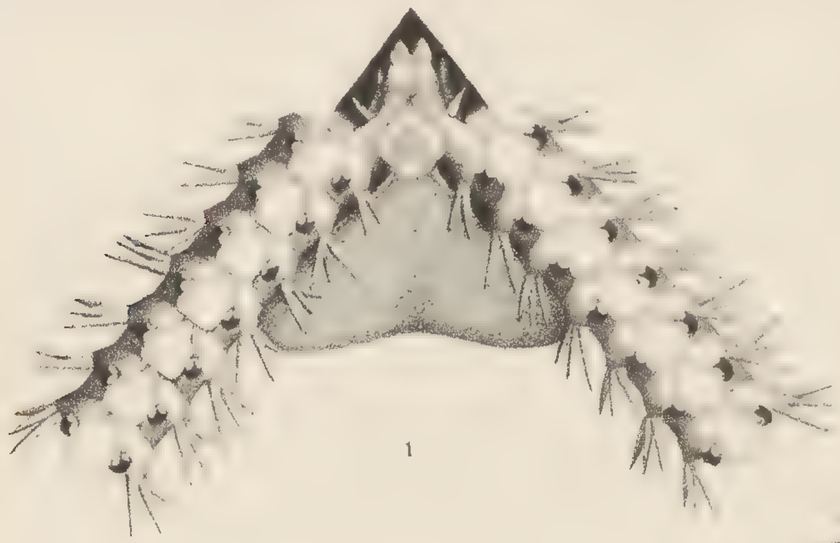
Amphiura serpentina n. sp.
1, 3 forma typica. 4–5 var. a. 6–8 var. b.

PLATE IX.

Fig. 1. *Amphiura serpentina* Ltk. & Mrtsn., var. *c*. Ventral side. $\frac{10}{1}$.
Fig. 2. " " " " Dorsal side. $\frac{10}{1}$.
Fig. 3. " *gymnogastra* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 4. " " " Dorsal side. $\frac{8}{1}$.
Fig. 5. " " " Arm-spines. $\frac{8}{1}$.
Fig. 6. " *polyacantha* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 7. " " " Dorsal side. $\frac{8}{1}$.
Fig. 8. " " " Arm-spines. $\frac{8}{1}$.



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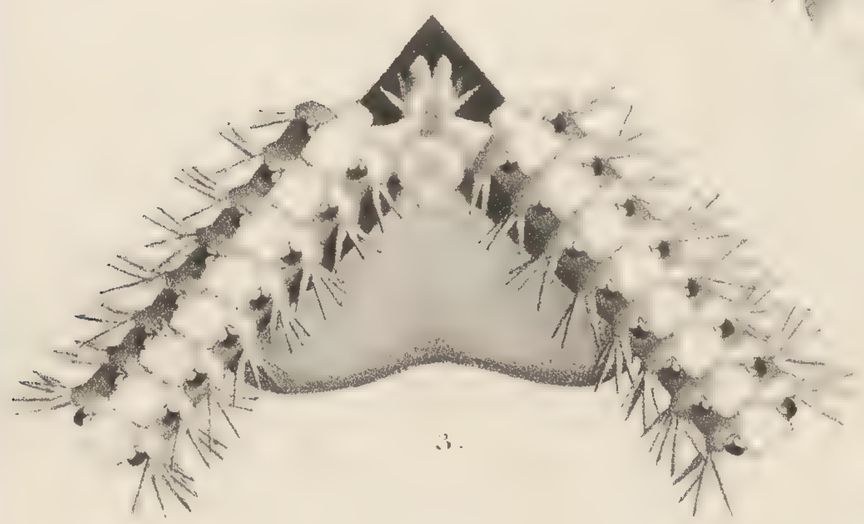

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1-2. Amphiura serpentina, var. c. 3-5 A. polyacantha n.sp. 6-8 A. gymnogastra n.sp.

PLATE X.

Fig. 1. *Amphiura granulata* Ltk. & Mrtsn. Ventral side. $\frac{10}{1}$.
Fig. 2. " " " Dorsal side. $\frac{10}{1}$.
Fig. 3. " " " Radial shields of another specimen. $\frac{10}{1}$.
Fig. 4. " " " Arm-spines. $\frac{10}{1}$.
Fig. 5. " *assimilis* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 6. " " " Dorsal side. $\frac{6}{1}$.
Fig. 7. " " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 8. *Amphilepis patens* Lym. Ventral side. $\frac{6}{1}$.
Fig. 9. " " " Dorsal side. $\frac{6}{1}$.
Fig. 10. " " " Arm-joints in side view. $\frac{6}{1}$.

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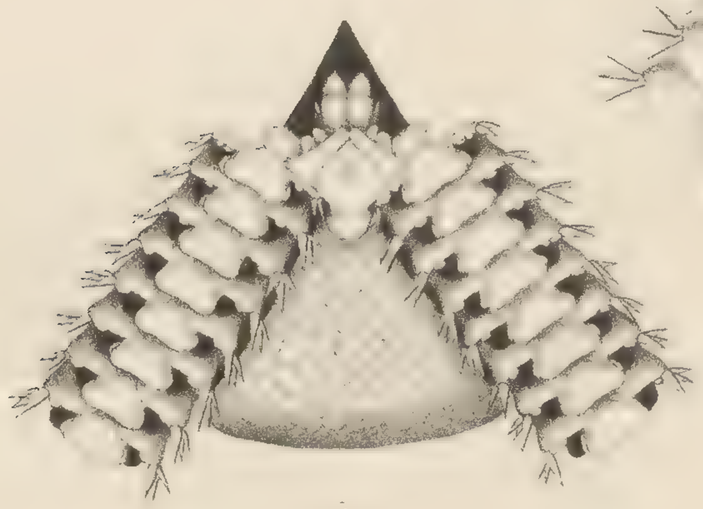

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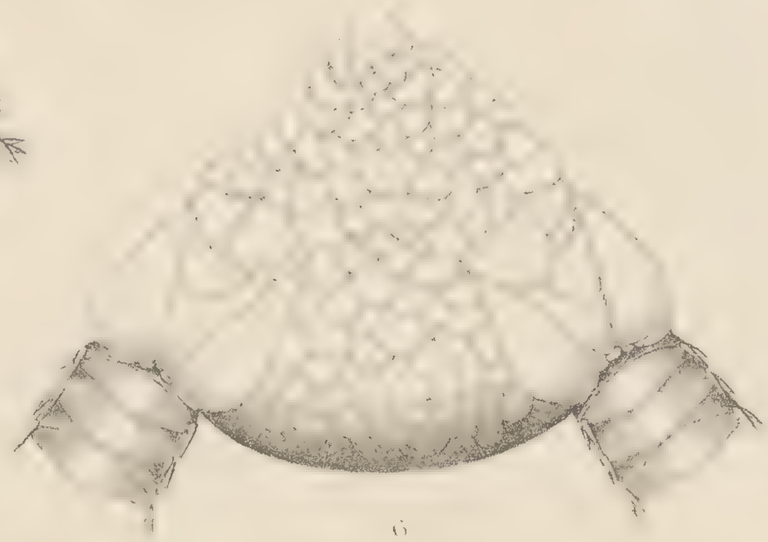

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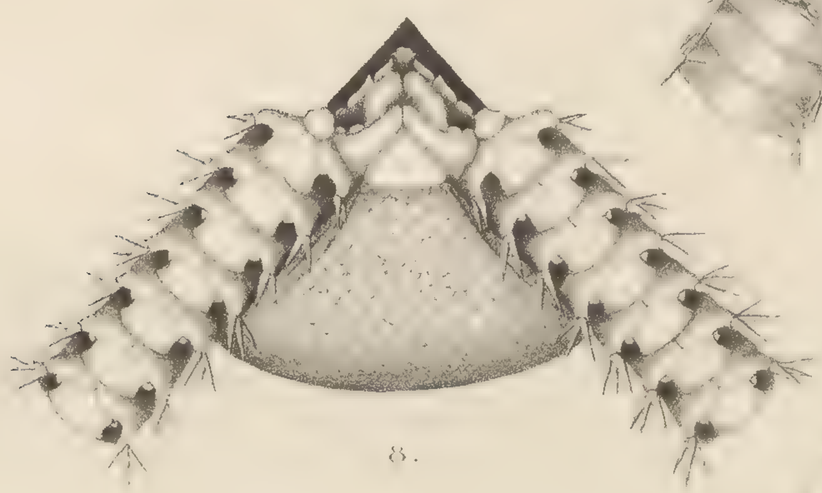

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1-4. Amphiura granulata n.sp. 5-7. A. assimilis n.sp. 8 10. Amphilepis patens Lym

PLATE XI.

Fig. 1. *Amphiura seminuda* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}^{0}$.
Fig. 2. " " " Dorsal side. $\frac{1}{1}^{0}$.
Fig. 3. " " " Arm-joints in side view. $\frac{1}{1}^{0}$.
Fig. 4. " *brevipes* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}^{0}$.
Fig. 5. " " " Dorsal side $\frac{1}{1}^{0}$.
Fig. 6. " " " Arm-joints in side view. $\frac{1}{1}^{0}$.
Fig. 7. " *gymnopora* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}^{2}$.
Fig. 8. " " " Dorsal side. $\frac{1}{1}^{2}$.
Fig. 9. " " " Arm-joints in side view. $\frac{1}{1}^{2}$.

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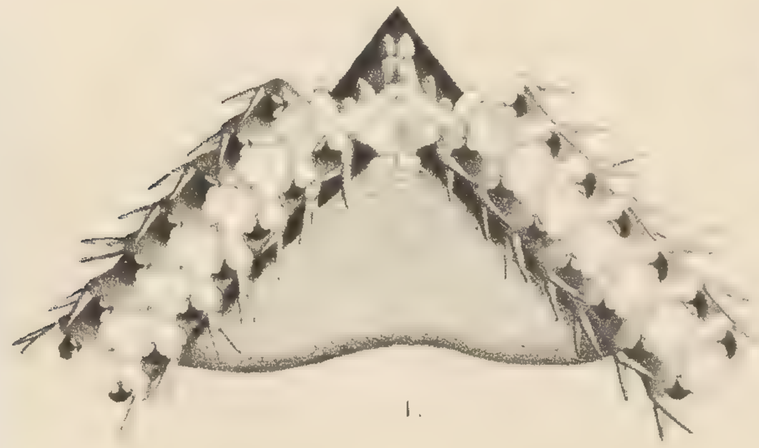
1-3. Amphiura seminuda n.sp. 4-6. A. brevipes n.sp. 7-9. A. gymnopora, n.sp.

PLATE XII.

Fig. 1. *Amphiura Diomedeæ* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 2. " " " Dorsal side. $\frac{6}{1}$.
Fig. 3. " " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 4. " " " Mouth angle of another specimen. $\frac{6}{1}$.
Fig. 5. " " " var. Ventral side. $\frac{12}{1}$.
Fig. 6. " " " " Dorsal side. $\frac{12}{1}$.
Fig. 7. " " " " Arm-joints in side view. $\frac{12}{1}$.
Fig. 8. " *dalea* Lym. Ventral side. $\frac{6}{1}$.
Fig. 8, *a*. " " Mouth shield of another specimen. $\frac{6}{1}$.
Fig. 9. " " Dorsal side. $\frac{6}{1}$.
Fig. 10. " " Arm-joints in side view. $\frac{6}{1}$.
Fig. 11. " " Ventral side of arm of another specimen. $\frac{6}{1}$.
Fig. 12. " " Ventral side of arm, farther out. $\frac{6}{1}$.



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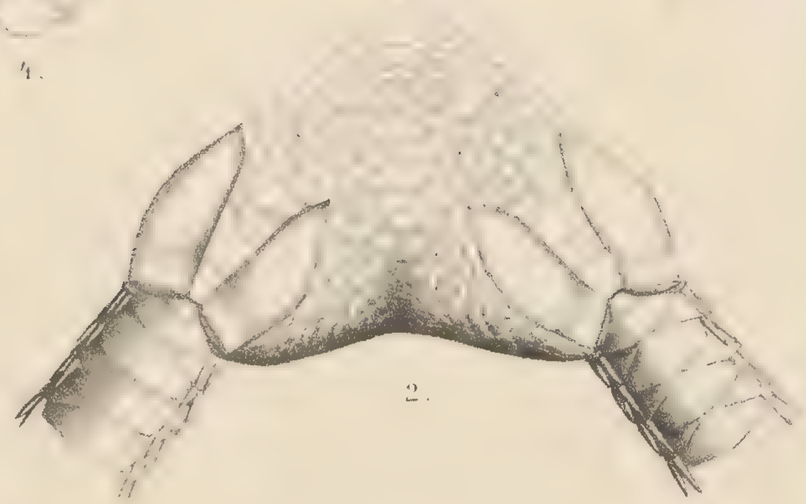

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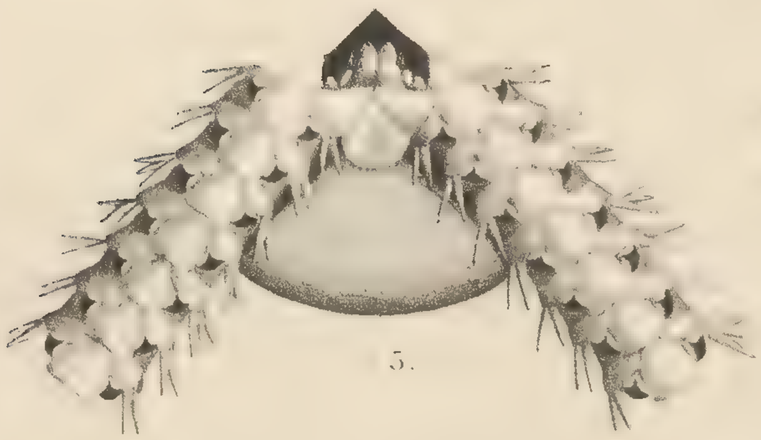

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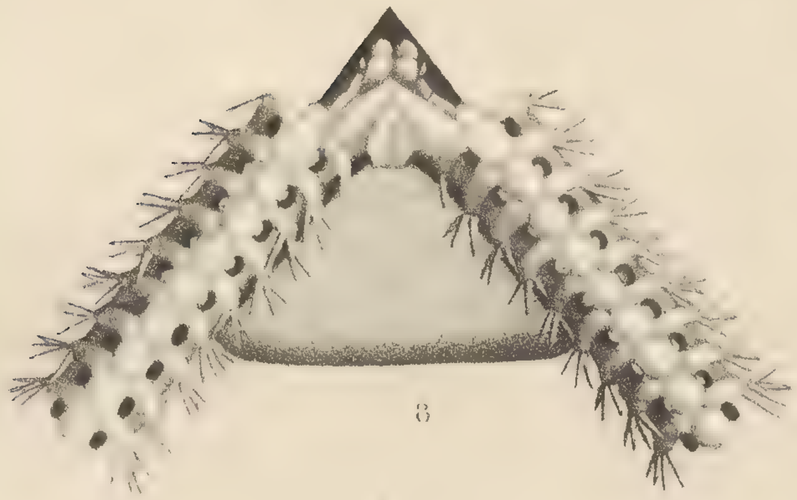

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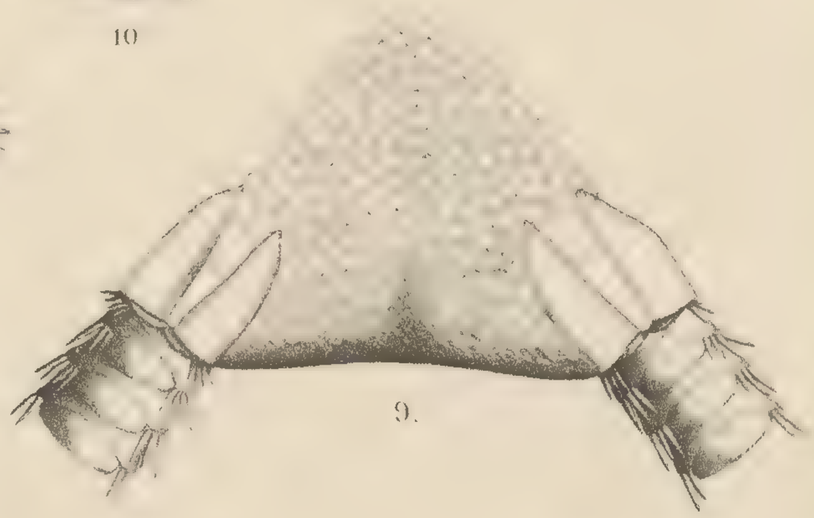

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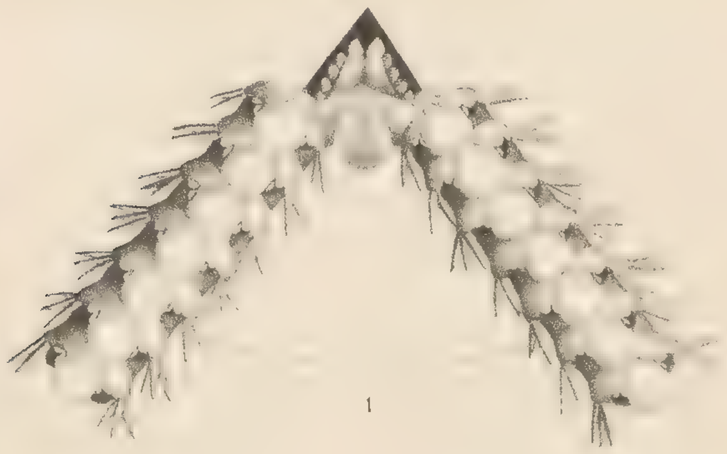
1–4. Amphiura Diomedeæ n.sp. 5–7 A. Diomedeæ, var. 8–12. A. dalea Lym.

PLATE XIII.

Fig. 1. *Amphiura* sp. Ventral side. $\frac{1}{1}$.
Fig. 2. " Dorsal side of arm. $\frac{1}{1}$.
Fig. 3. " Arm-joints in side view. $\frac{1}{1}$.
Fig. 4. " *gastracantha* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}$.
Fig. 5. " " " Dorsal side. $\frac{1}{1}$.
Fig. 6. " " " Arm-joints in side view. $\frac{1}{1}$.
Fig. 7. " *notacantha* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}$.
Fig. 8. " " " Dorsal side. $\frac{1}{1}$.
Fig. 9. " " " Arm-joints in side view. $\frac{1}{1}$.
Fig. 10. *Ophionereis reticulata* Ltk. Dorsal side of arm. $\frac{1}{1}$.
Fig. 11. " *annulata* Lym. Dorsal side of arm. $\frac{1}{1}$.
Fig. 12. " sp. Dorsal side of arm. $\frac{1}{1}$.



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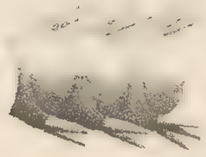

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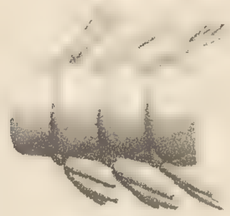

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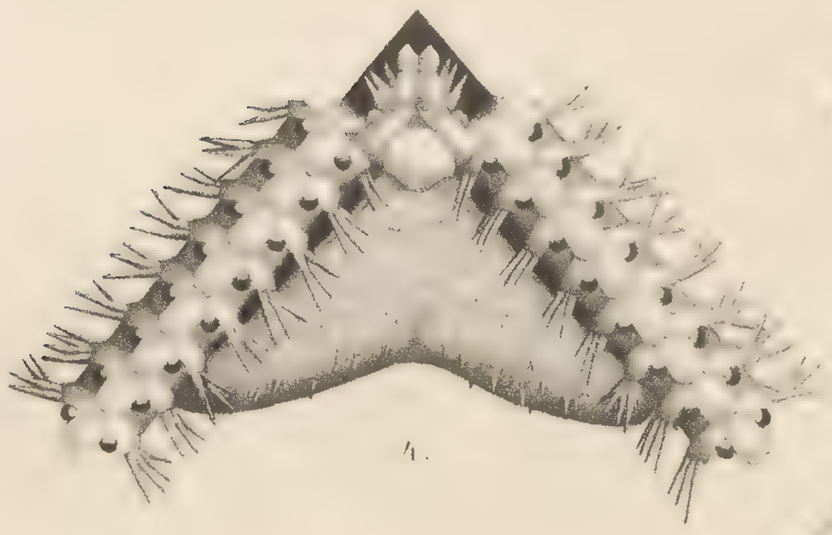

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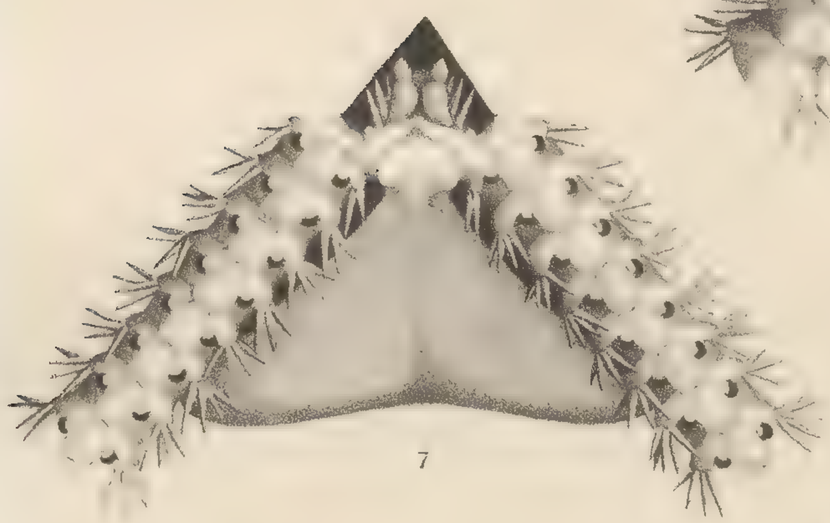

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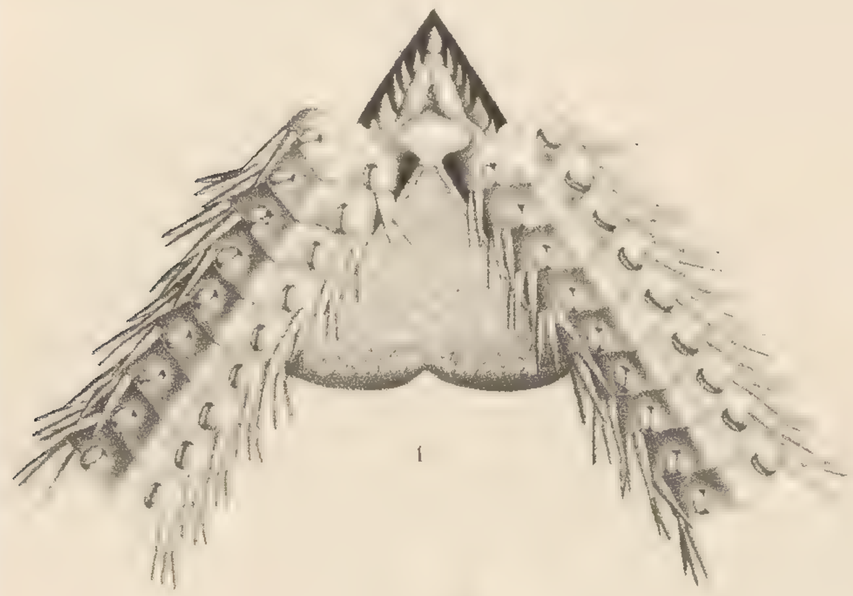
13. Amphiura sp. 4-6 A. gastracantha n.sp. 7-9. A. notacantha. n.sp. 10. Ophionereis reticulata Ltk.

11. O. annulata Lym. 12. O. sp.

PLATE XIV.

Fig. 1. *Ophiochiton carinatus* Ltk. & Mrtsn. Ventral side. $\frac{4}{1}$.
Fig. 2. " " " Dorsal side. $\frac{4}{1}$.
Fig. 3. " " " Arm-spines. $\frac{4}{1}$.
Fig. 4. *Amphiura papillata* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 5. " " " Dorsal side. $\frac{8}{1}$.
Fig. 6. " " " Arm-joints in side view. $\frac{8}{1}$.
Fig. 7. *Ophionereis nuda* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 8. " " " Dorsal side. $\frac{8}{1}$.
Fig. 9. " " " Arm-spines. $\frac{8}{1}$.



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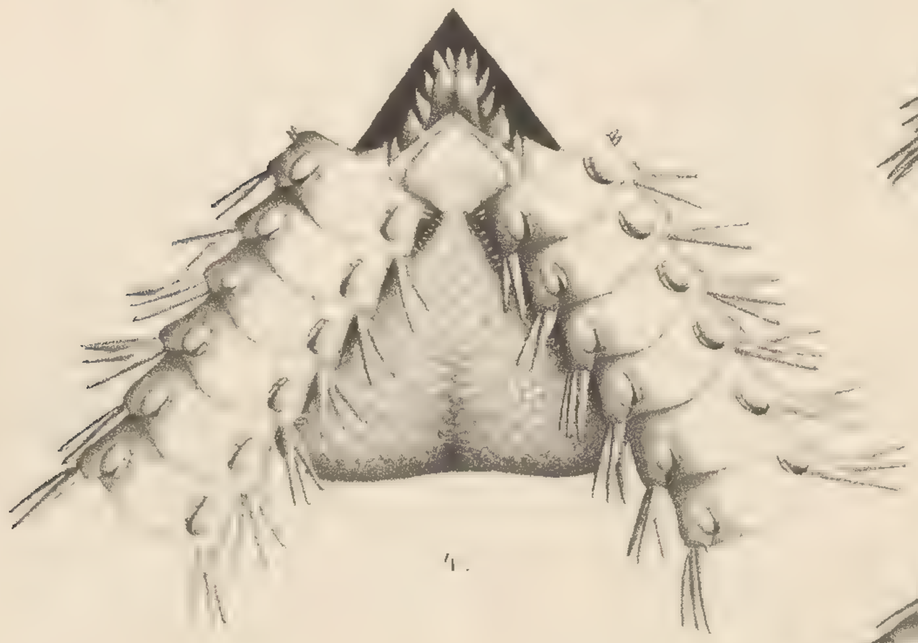

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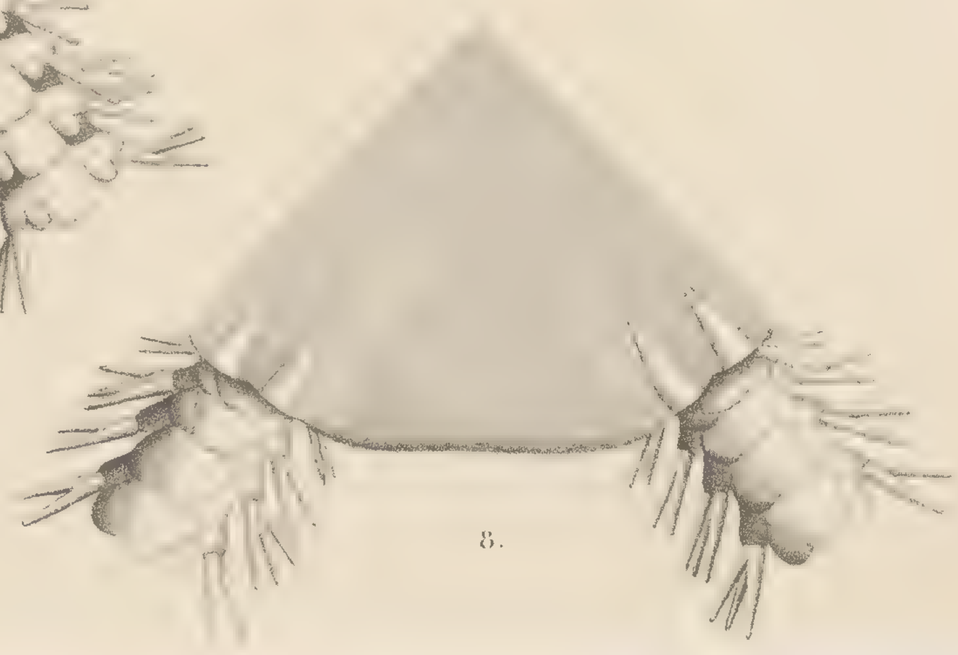

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1-3. Ophiochiton carinatus n.sp. 4-6. Amphiura papillata n.sp. 7-9. Ophionereis nuda n.sp.

PLATE XV.

Fig. 1. *Ophiacantha cosmica* Lym. $\frac{6}{1}$.
Fig. 2. " " " Dorsal side of arm. $\frac{6}{1}$.
Fig. 3. " " " Spine of the disk. Seibert Obj. II. Oc. 0.
Fig. 4. " *pacifica* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 5. " " " Dorsal side. $\frac{6}{1}$.
Fig. 6. " " " Arm-spines. $\frac{6}{1}$.
Fig. 7. " *inconspicua* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 8. " " " Dorsal side. $\frac{8}{1}$.
Fig. 9. " " " Dorsal side of arm, farther out. $\frac{8}{1}$.
Fig. 10. " " " Arm-spines. $\frac{8}{1}$.
Fig. 11, *a–c* " " " Spines of the disk. Seibert Obj. II. Oc. 0.

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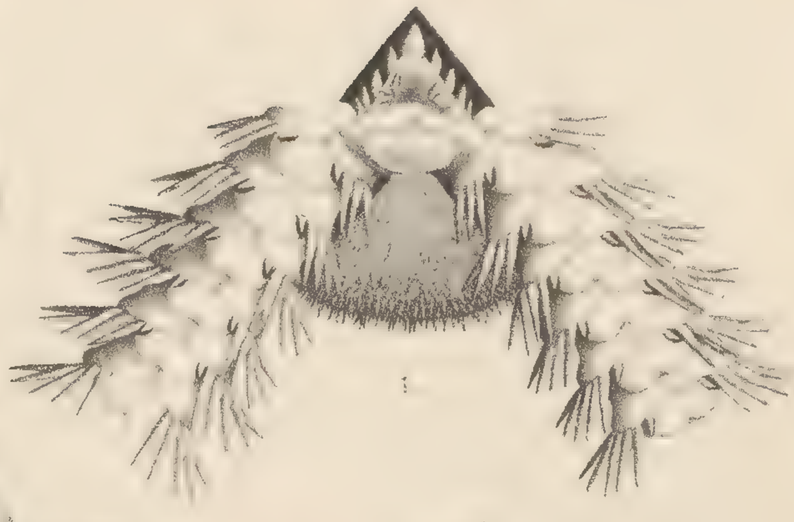

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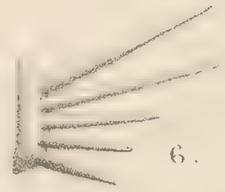

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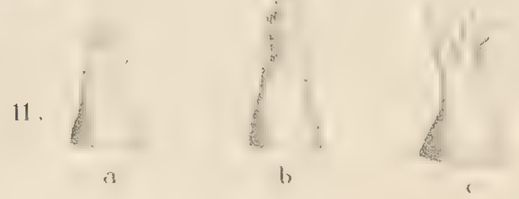

11. a b c

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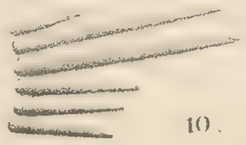

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1-3. Ophiacantha cosmica Lym. 4-6. O. pacifica n.sp. 7-11 O. inconspicua n.sp.

PLATE XVI.

Fig. 1. *Ophiacantha Normani* Lym. Dorsal side. $\frac{4}{1}$.
Fig. 2. " " " Ventral side. $\frac{4}{1}$.
Fig. 3. " " " Arm-spines. $\frac{4}{1}$.
Fig. 4. " " " Grain from the disk. Seibert Obj. II. Oc. 0.
Fig. 5. " *moniliformis* Ltk. & Mrtsn. Dorsal side. $\frac{8}{1}$.
Fig. 6. " " " Ventral side. $\frac{8}{1}$.
Fig. 7. " " " Arm-joints in side view. $\frac{8}{1}$.
Fig. 8. " " " Spine from the disk. Seibert. Obj. II. Oc. 0.
Fig. 9. " *spinifera* Ltk. & Mrtsn. Spine of the disk. Seibert Obj. II. Oc. 0.
Fig. 10. " *costata* Ltk. & Mrtsn. Spine of the disk. Seibert Obj. II. Oc. 0.
Fig. 11. " *pacifica* Ltk. & Mrtsn. Spine of the disk. Seibert Obj. II. Oc. 0.
Fig. 12. " *contigua* Ltk. & Mrtsn. Spine of the disk. Seibert Obj. II. Oc. 0.

1-4. Ophiacantha Normani Lym. 5-8. O. moniliformis n.sp. 9. O. spinifera n.sp.
10. O. costata n.sp. 11. O. pacifica n.sp. 12. O. contigua n.sp.

PLATE XVII.

Fig. 1.	*Ophiacantha spinifera* Ltk. & Mrtsn.		Ventral side.	$\frac{6}{1}$.
Fig. 2.	"	"	"	Dorsal side.	$\frac{6}{1}$.
Fig. 3.	"	"	"	Arm-spines.	$\frac{6}{1}$.
Fig. 4.	"	*costata* Ltk. & Mrtsn.		Ventral side.	$\frac{6}{1}$.
Fig. 5.	"	"	"	Dorsal side.	$\frac{6}{1}$.
Fig. 6.	"	"	"	Arm-spines.	$\frac{6}{1}$.
Fig. 7.	"	*contigua* Ltk. & Mrtsn.		Ventral side.	$\frac{10}{1}$.
Fig. 8.	"	"	"	Dorsal side.	$\frac{10}{1}$.
Fig. 9.	"	"	"	Arm-spines.	$\frac{10}{1}$.

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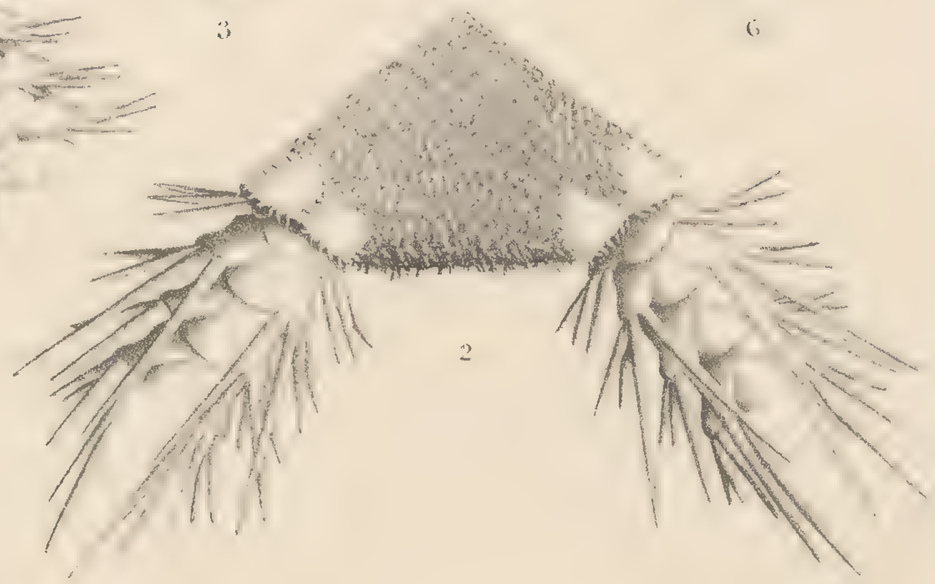

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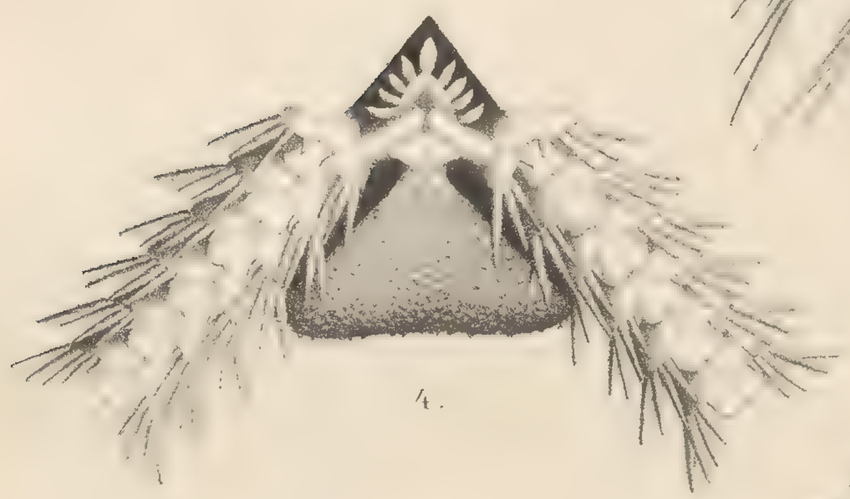

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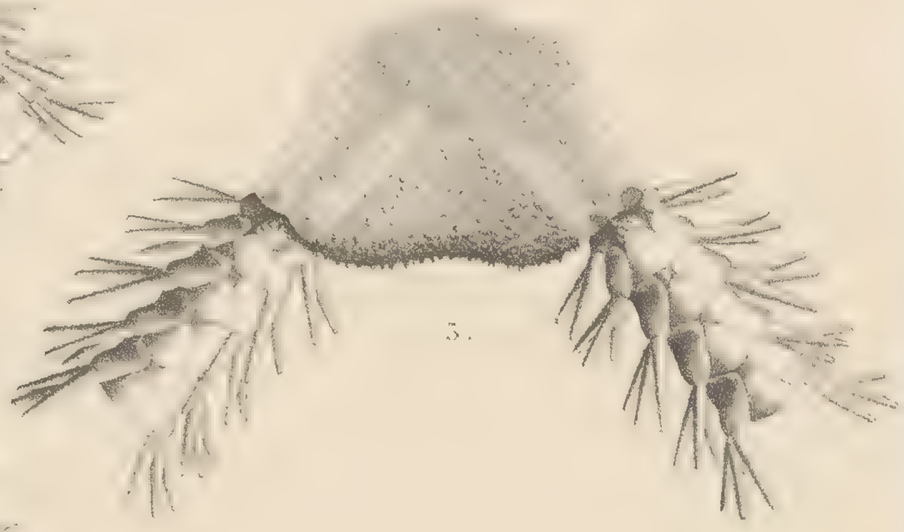

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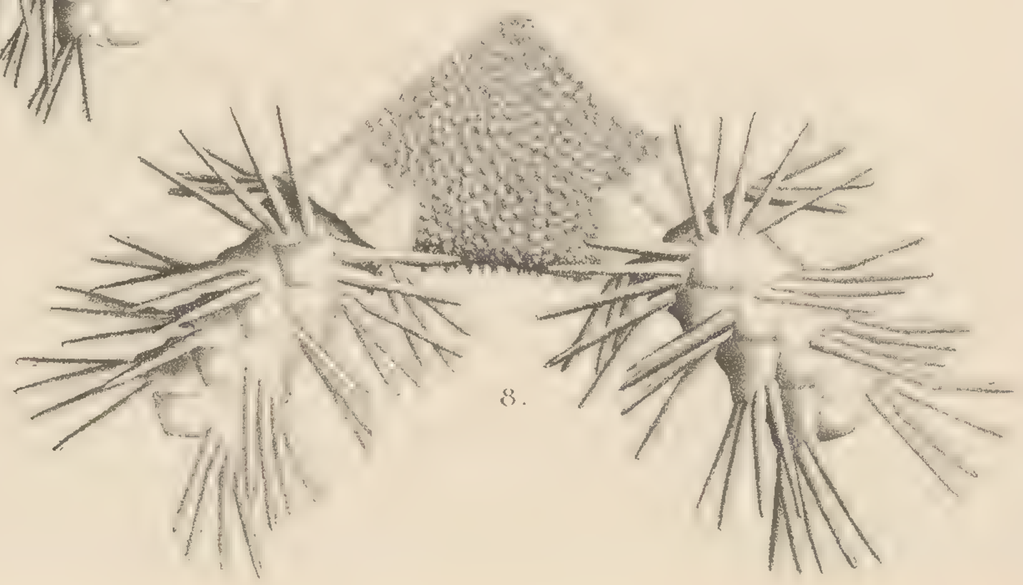

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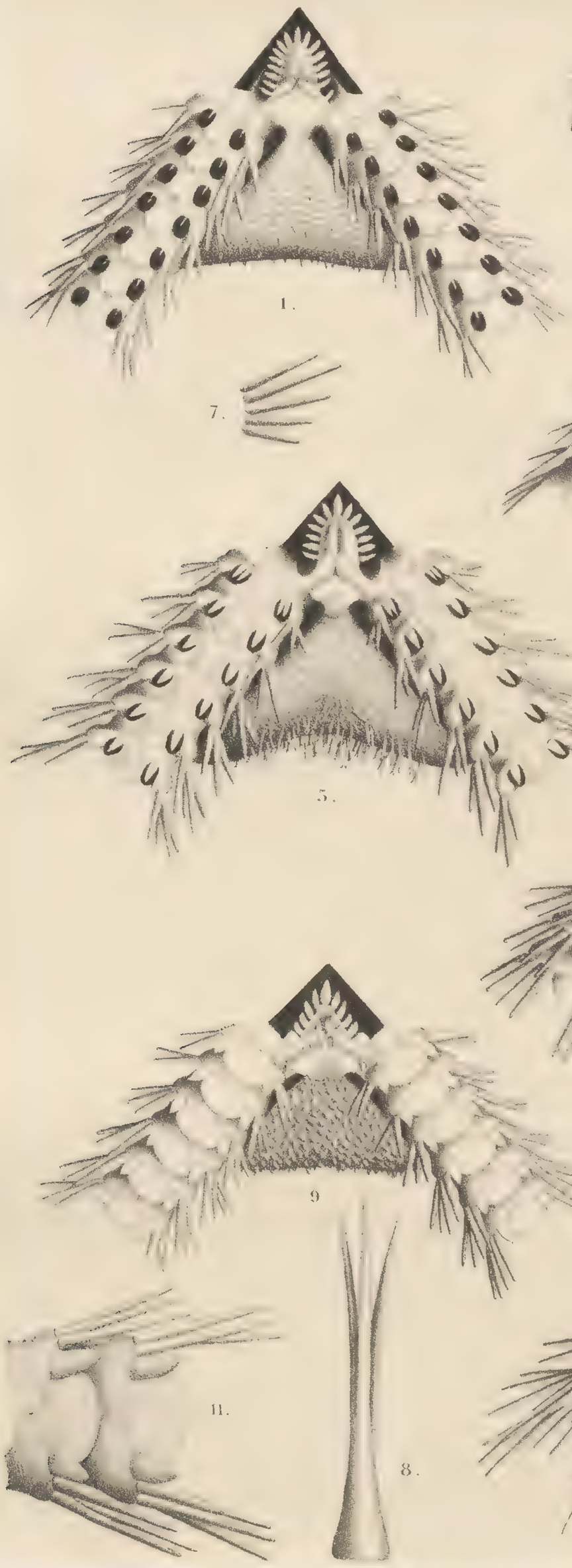
1-3. Ophiacantha spinifera n.sp. 4-6. O. costata n.sp. 7-9. O. contigua n.sp.

PLATE XVIII.

Fig. 1. *Ophiacantha pauci*×*pina* Ltk. & Mrtsn. Ventral side. $\frac{4}{1}$.
Fig. 2. " " " Dorsal side. $\frac{4}{1}$.
Fig. 3. " " " Arm-joints in side view. $\frac{4}{1}$.
Fig. 4. " " " Spine of the disk. Seibert Obj. II. Oc. 0.
Fig. 5. " *hirta* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 6. " " " Dorsal side. $\frac{6}{1}$.
Fig. 7. " " " Arm-spines. $\frac{6}{1}$.
Fig. 8. " " " Spine of the disk. Seibert Obj. II. Oc. 0.
Fig. 9. " *Bairdi* Lym. Ventral side. $\frac{8}{1}$.
Fig. 10. " " Dorsal side. $\frac{8}{1}$.
Fig. 11. " " Arm-joints in ventral view, showing the parallel ridges. $\frac{16}{1}$.
Fig. 12. " " Arm-spines. $\frac{8}{1}$.
Fig. 13, *a*, *b*. " " Spines of the disk. Seibert Obj. II. Oc. 0.



1-4. Ophiacantha paucispina n.sp. 5-8. O.hirta n.sp. 9 13.O.Bairdi Lym.

PLATE XIX.

Fig. 1. *Ophiothamnus lævis* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}^0$.
Fig. 2. " " " Dorsal side. $\frac{1}{1}^0$.
Fig. 3. " " " Arm-joints in side view. $\frac{1}{1}^0$.
Fig. 4. " " " Lower arm-spine from the outer part of the arm. Seibert Obj. II. Oc. 0.
Fig. 5. *Ophiomitra partita* Ltk. & Mrtsn. Ventral side. $\frac{1}{1}^0$.
Fig. 6. " " " Dorsal side. $\frac{1}{1}^0$.
Fig. 7. " " " Arm-spines. $\frac{1}{1}^0$.
Fig. 8, *a*, *b*. " " " Spines of the disk from above (*a*) and in side view (*b*). Seibert Obj. II. Oc. 0.
Fig. 9. " *granifera* Ltk. & Mrtsn. Ventral side. $\frac{6}{1}$.
Fig. 10. " " " Dorsal side. $\frac{6}{1}$.
Fig. 11. " " " Arm-spines. $\frac{6}{1}$.
Fig. 12. " " " Grain from the disk. Seibert Obj. II. Oc 0.

1-4. Ophiothamnus lævis n.sp. 5-8. Ophiomitra partita n.sp. 9-12. O. granifera n.sp.

PLATE XX.

Fig. 1. *Ophiothrix galapagensis* Ltk. & Mrtsn. Ventral side. $\frac{10}{1}$.
Fig. 2. " " " Dorsal side. $\frac{10}{1}$.
Fig. 3. " " " Arm-spines. $\frac{10}{1}$.
Fig. 4, *a*, *b*. " " " Spines of the disk. Seibert Obj. II. Oc. 0.
Fig. 5. *Sigsbeia lineata* Ltk. & Mrtsn. Ventral side. $\frac{8}{1}$.
Fig. 6. " " " Dorsal side. $\frac{8}{1}$.
Fig. 7. " " " Arm-joints in side view. $\frac{8}{1}$.
Fig. 8. " " "

1.

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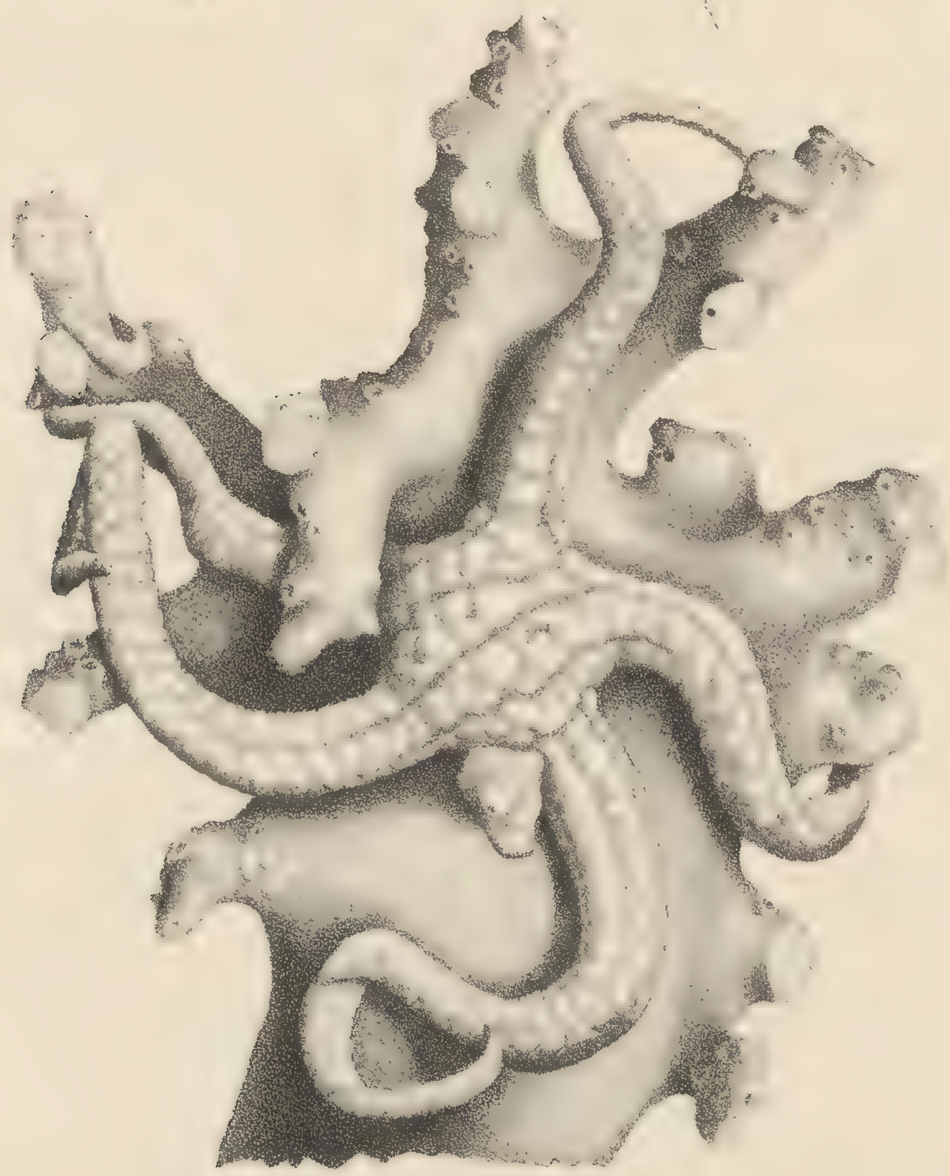

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4a.

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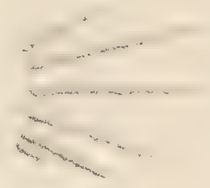

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1-4. Ophiothrix galapagensis n.sp. 5-8 Sigsbeia lineata n.sp

PLATE XXI.

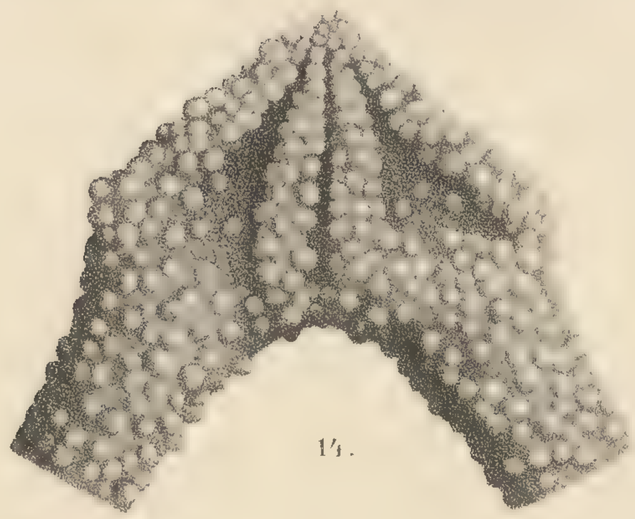
Fig. 1. *Asteronyx dispar* Ltk. & Mrtsn. Natural size.
Fig. 2. " " " Ventral side.
Fig. 3. " *plana* Ltk. & Mrtsn. Ventral side.
Fig. 4. " " " Dorsal side.
Fig. 5. *Gorgonocephalus Diomedeæ* Ltk. & Mrtsn. Ventral side.

1-2 Asteronyx dispar n.sp. 3-4 A.plana n.sp. 5.Gorgonocephalus Diomedeæ n.sp.

PLATE XXII.

Fig. 1. *Gorgonocephalus Diomedeæ* Ltk. & Mrtsn. Dorsal side. Natural size.
Fig. 2. *Asteronyx excavata* Ltk. & Mrtsn. Ventral side.
Fig. 3. " " " " Dorsal side.
Fig. 4. " " " " Side view of arm, in the larger part of it.
Fig. 5. " " " " Ventral view of arm, in the larger part of it.
Fig. 6. " " " " Arm-spines.
Fig. 7. " *plana* Ltk. & Mrtsn. Side view of arm.
Fig. 8. " " " Ventral view of arm.
Fig. 9. " " " Arm-spines.
Fig. 10. " *dispar* Ltk. & Mrtsn. Side view of arm, in the larger part of it.
Fig. 11. " " " Ventral view of arm, in the larger part of it.
Fig. 12. " " " Arm-spines.
Fig. 13. *Astroschema sublæve* Ltk. & Mrtsn. Ventral side.
Fig. 14. " " " " Dorsal side.

13.



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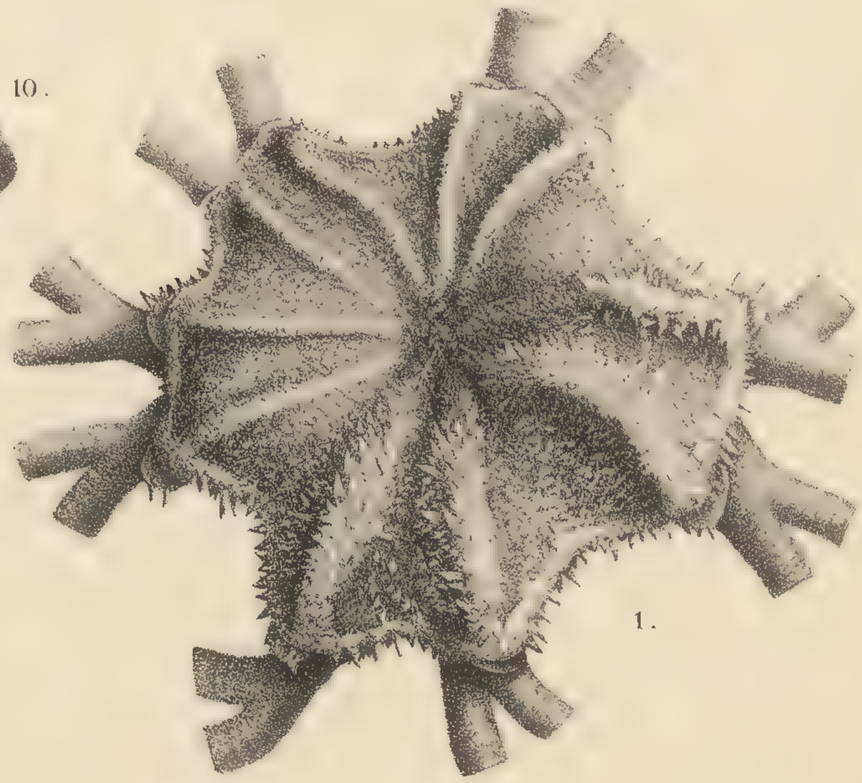

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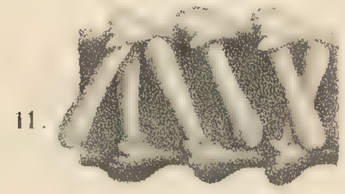

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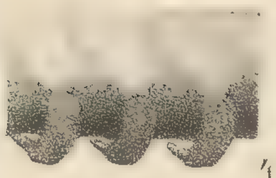

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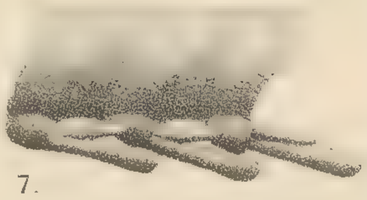

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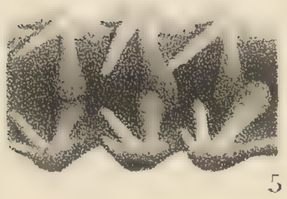

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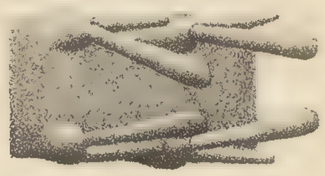

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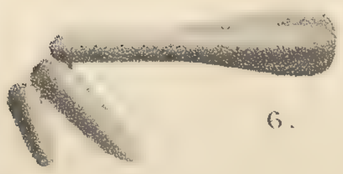

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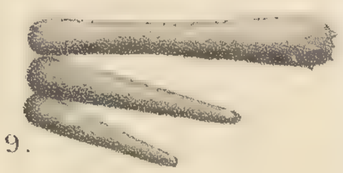

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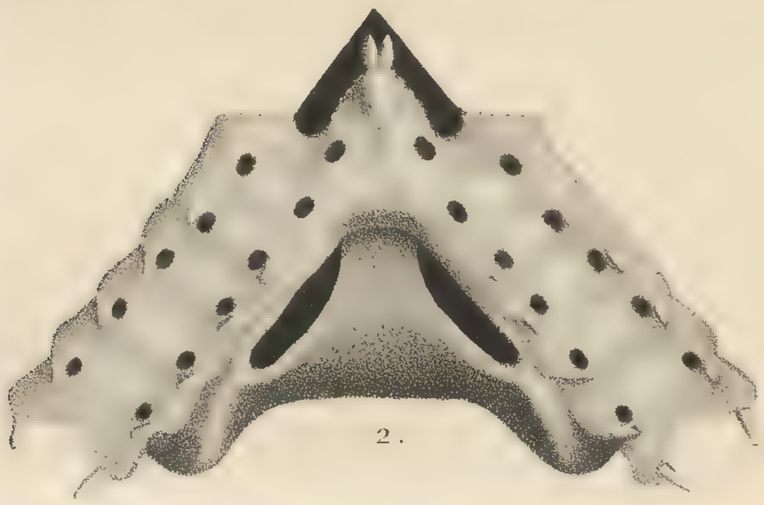

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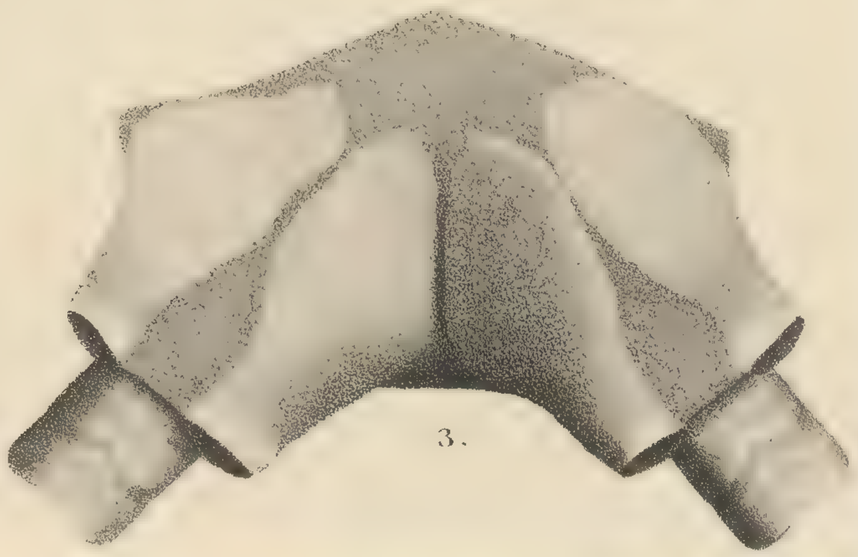

3.

1. Gorgonocephalus Diomedeæ n.sp. 2-6. Asteronyx excavata n.sp. 7-9. A. plana n.sp.

10 12. A. dispar n.sp. 13 14. Astroschema sublæve n.sp.

PLATE XXIII.

CHART OF THE ROUTE OF THE ALBATROSS.

EXPLORATIONS OF THE
U.S. FISH COMMISSION
STEAMER ALBATROSS
Lieut.-Comdr. Z.L. Tanner, U.S.N., Comdg.
February to April 1891
Compiled from the latest U.S. Hydrographic Office charts with additions by the U.S.F.C. Steamer Albatross.
Soundings represented thus: 2756 are by the U.S.F.C. Str. "Albatross" 1888 1889 1891
2748 "
2705 "
2204 " are from other sources
100 fathom line shown thus:
500 " " " "
1000 " " " "
1500 " " " "
2000 " " " "
P. Pebble, Cs. coral, G. globigerina, m. mud, O. ooze, S. sand, St. stella
Sp. specimen, G. gravel, R. rock, bld. bl. red, brn. brown, cly. clay, gn. green, gy. grey, l. coloured, lt. light
bk. black, rd. red, rky. rocky, wh. white.
MEXICO
GULF OF MEXICO
CARIBBEAN SEA
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
COLOMBIA
CALIFORNIA
Gulf of California
Gulf of Panama
GUAYMAS
Agiabampo
Topolobampo
Altata
MAZATLAN
San Blas
Banderas Bay
C. CORRIENTES
Manzanillo
Maruata
Petacalco Bay
ACAPULCO
P. Angeles
TEHUANTEPEC
Salina Cruz
La Puerta
Champerico
S. José
Acajutla
Salvador
La Libertad
Gulf of Fonseca
Corinto
Gulf of Nicoya
Gulf of Dulce
Mariato Pt.
C. Mala
PANAMA
C. Corrientes
Chocó Bay
C. San Francisco
C. San Lorenzo
Pinas Bay
Guiara Pt.
Malpelo I.
Cocos I.
Revilla Gigedo Islands
Roca Partida
Socorro
Clarion I.
Rocas Alijos
Tres Marias Is.
Magdalena Bay
Conception Bay
Guillermo Bay
LA PAZ
C. SAN LAZARO
C. SAN LUCAS
Tropic of Cancer
Track of the U.S.F.C. Str. "Albatross" (1891)
GALAPAGOS ISLANDS
(For Soundings around the Galapagos Islands see Plate XXIII)
Culpepper I.
Wenman I.
Abingdon I.
Bindloe I.
Albemarle I.
Narborough I.
Tower I.
Duncan I.
Chatham I.
Hood I.
Barrington I.
James I.
Charles I.
Indefatigable I.
Jervis I.
Bainbridge I.
Barrington I.
Seymour I.
Baltra I.
Daphne I.
Gardner I.
Hood I.
Gardner I.
Champion I.
Gardner I.
Enderby I.
Seymour I.
Baltra I.
Daphne I.
Gardner I.
Hood I.
Gardner I.
Champion I.
Gardner I.
Enderby I.

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The following Publications of the Museum contain Reports on the Dredging Operations in charge of Alexander Agassiz, of the U. S. Fish Commission Steamer "Albatross," during 1891, Lieut. Commander Z. L. Tanner, U. S. N., Commanding.

Three Letters from ALEXANDER AGASSIZ to the Hon. Marshall McDonald, U. S. Commissioner of Fish and Fisheries, on the Dredging Operations of the "Albatross" in 1891. Bull. M. C. Z., Vol. XXI. No. 4. June, 1891. 16 pp.

I. A. AGASSIZ. On Calamocrinus Diomedæ, a new Stalked Crinoid from the Galapagos. Mem. M. C. Z., Vol. XVII. No. 2. January, 1892. 95 pp. 32 Plates.

II A. AGASSIZ. General Sketch of the Expedition of the "Albatross," from February to May, 1891. Bull. M. C. Z., Vol. XXIII. No. 1. February, 1892. 89 pp. 22 Plates.

III. A. GOËS. Neusina Agassizi. Bull. M. C. Z., Vol. XXIII. No. 5. December, 1892. 4 pp. 1 Plate.

IV H. LUDWIG. Vorläufiger Bericht über die erbeuteten Holothurien. Zeit. Anz., No. 420. 1893. Bull. M. C. Z., Vol. XXIV. No. 4. June, 1893. 10 pp.

V. GEO. P. MERRILL. The Rocks of the Galapagos. Bull. M. C. Z., Vol. XVI. No. 13. July, 1893. 3 pp.

VI. W. FAXON. Preliminary Descriptions of new Species of Crustacea. Bull. M C. Z., Vol. XXIV. No. 7. August, 1893. 72 pp.

VII. S. H. SCUDDER. The Orthoptera of the Galapagos. Bull. M. C. Z., Vol. XXV. No. 1. September, 1893. 25 pp. 3 Plates.

VIII. W. SCHIMKÉWITSCH. The Pygnogonidæ. Bull. M. C. Z., Vol. XXV. No. 2. December, 1893. 17 pp. 2 Plates.

IX. W. McM. WOODWORTH. The Planarians. Bull. M. C. Z., Vol. XXV. No. 4. January, 1894. 4 pp. 1 Plate.

X. TH. STUDER. Note préliminaire sur les Alcyonaires. Bull. M. C. Z., Vol. XXV. No. 5. February, 1894. 17 pp.

XI. S. F. CLARKE. The Hydroids. Bull. M. C. Z., Vol. XXV. No. 6. February, 1894. 7 pp. 5 Plates.

XII. H. LUDWIG. The Holothurians. Mem. M. C. Z., Vol. XVII. No. 3. October, 1894. 183 pp. 19 Plates.

XIII. R. BERGH. Die Opisthobranchien. Bull. M. C. Z., Vol. XXV. No. 10. October, 1894. 109 pp. 12 Plates.

XIV. A. ORTMANN. The Pelagic Schizopoda. Bull. M. C. Z., Vol. XXV. No. 8. September, 1894. 13 pp. 1 Plate.

XV. W. FAXON. The Crustacea. Mem. M. C. Z., Vol. XVIII. April, 1895. 292 pp. 67 Plates.

XVI. W. GIESBRECHT. Die Pelagischen Copepoden. Bull. M. C. Z., Vol. XXV. No. 12. April, 1895. 20 pp. 4 Plates.

XVII. C. H. TOWNSEND. The Birds of Cocos Island. Bull. M. C. Z., Vol. XXVII. No. 3. July, 1895. 8 pp. 2 Plates.

XVIII. C. HARTLAUB. Die Comatuliden. Bull. M. C. Z., Vol. XXVII. No. 4. August, 1895. 26 pp. 4 Plates.

XIX. G. W. MÜLLER. Die Ostracoden. Bull. M. C. Z., Vol. XXVII. No. 5. October, 1895. 10 pp. 3 Plates.

XX. A. GOËS. The Foraminifera. Bull. M. C. Z., Vol. XXIX. No. 1. February, 1896. 103 pp. 9 Plates.

XXI. O. MAAS. Die Medusen. Mem. M. C. Z., Vol. XXIII. No. 1. September, 1897. 92 pp. 15 Plates.

XXII. H. J. HANSEN. The Isopoda. Bull. M. C. Z., Vol. XXXI. No. 5. December, 1897. 38 pp. 6 Plates.

XXIII. A. AGASSIZ. Preliminary Report on the Echini. Bull. M. C. Z., Vol. XXXII. No. 5. June, 1898. 18 pp. 14 Plates.

XXIV. E. L. MARK. Preliminary Report on Branchiocerianthus urceolus. Bull. M. C. Z., Vol. XXXII. No. 8. August, 1898. 8 pp. 3 Plates.

XXV. C. F. LÜTKEN and TH. MORTENSEN. The Ophiuridæ. Mem. M. C. Z., Vol. XXIII. No. 2. November, 1899. 114 pp. 22 Plates and Chart.

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